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VOLUME 8, No. 11 **NOVEMBER 1956**

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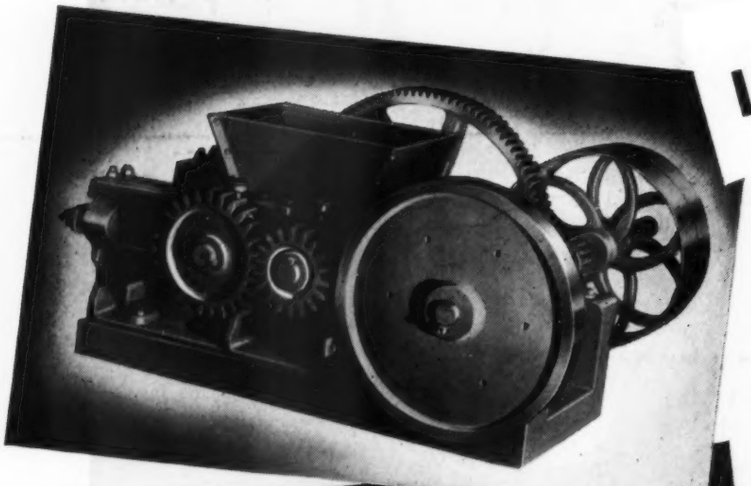

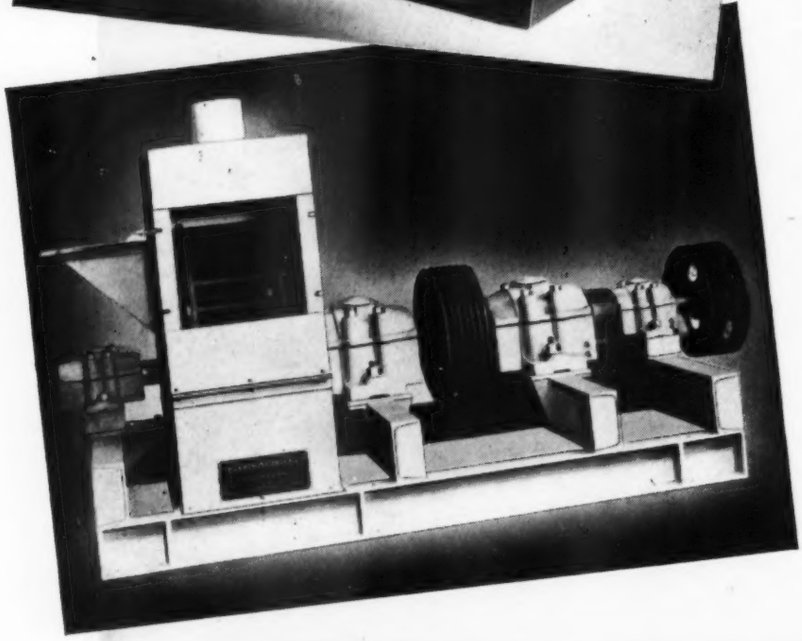

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WORLD CROPS

Vol. 8, No. 11 NOVEMBER 1956

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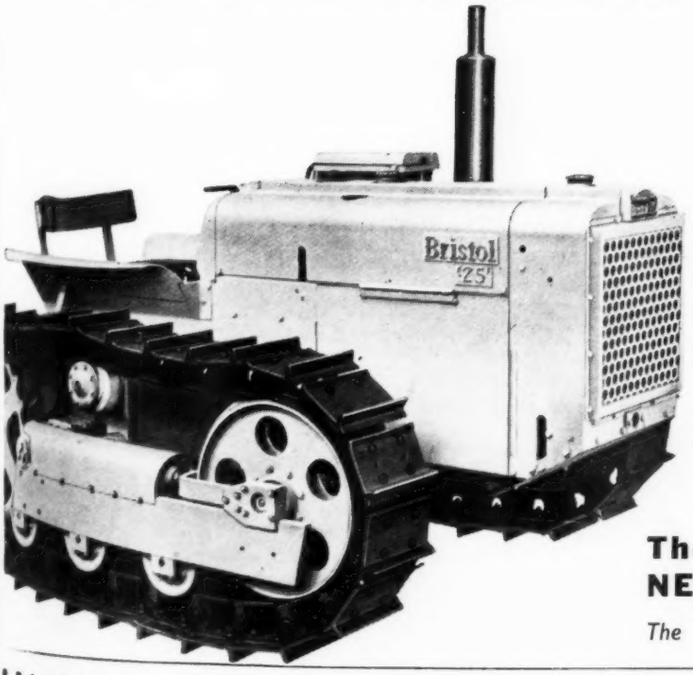

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Editorial Comment

Bounteous field of wheat

A RESEARCH station, the first of its kind, for the study of wheat and its use in the production of flour and bread is expected to be opened soon at Glasnevin, Dublin. Up to the present, research on Irish wheat or flour was carried out in British research stations, except for private tests carried out by Irish flour millers or bakeries in their own establishments.

The station will be operated in conjunction with the Institute for Industrial Research and Standards, and one of its main tasks will be to see if a palatable batch loaf of reasonable quality can be produced from Irish wheat. Among the subjects to be examined will be the standardisation of methods to determine moisture in wheat, the study of methods and equipment used in the artificial drying of wheat, laboratory tests of samples of flour available to bakeries and the study of excessive enzyme activity.

The new research centre follows the setting up of a committee to advise the Minister for Industry and Commerce on the problems arising from the use of Irish wheat in the making of bread. The question of Irish wheat and the percentage extraction for flour has been under consideration by the Minister for Industry and Commerce for about two years. The Government has promised a grant of £5,000 for the new research committee, which includes scientists, millers, confectioners, bakers and the Department of Agriculture.

World agricultural production

THE recent announcement by FAO that world food and agricultural production rose by 3% in 1955–56 has a more sombre aspect. With a further small increase in world agricultural production expected in 1956–57, there is no immediate prospect of substantial reductions in stocks of the main surplus commodities.

The largest production increases in 1955–56 were in North America and Oceania, areas already most troubled by surpluses. According to FAO, there was also a substantial gain in the Far East, but production in other regions showed little change or in some cases even declined. World production of cotton and grains recovered from the lower levels of 1954–55, and output of most forest products reached record levels.

In Latin America, Oceania and the Far East, where standards of living have always been low, *per caput* food production in 1955–56 was still some 5 to 10% less than before the second world war.

Prices have continued to move against the farmer in most countries, though in Europe prices of livestock products have been maintained. The prices of important farm requisites have risen in nearly all countries. Farm incomes appear generally to have declined between 1954 and 1955 or, at least, to have made only very limited gains, in sharp contrast to the rising trend of incomes in other occupations.

Falls in farm prices have not, however, been accompanied by any general or appreciable fall in retail food prices. FAO says that in part this appears to be because marketing margins have continued to increase.

The continuing accumulation of surplus stocks of some commodities, together with the declines in farm incomes, have led to changes in agricultural policies in a number of countries. The most important new measure was the U.S. Agricultural Act of 1956 to curtail production by means of the ' Soil Bank '. Elsewhere changes have been less radical. In some countries, mainly in Western Europe, there have been changes in emphasis in farm-price policies, designed to adjust production more closely to present circumstances. There has also been an increasing trend towards helping farmers to reduce costs by improving the farm structure or by subsidising means of production. In the less-developed parts of the world, however, a continued rapid expansion of agricultural production is still the chief need and remains the primary aim of national policies. In 1955–56 several of the more important postwar development plans were completed and new plans prepared or implemented to follow up the earlier progress.

FAO suggests that the present economic situation seems likely to continue at least during the early part of 1956–57. There might be some temporary decline in economic activity under the influence of anti-inflationary measures, but increasing public expenditure and private industrial investment might lead to some further expansion in the latter part of the year. The demand for agricultural products is likely to stay high, but not to increase appreciably, though prices of agricultural raw materials, except possibly wool, might continue to ease.

Appraising the general situation and outlook, FAO's annual report on ' The State of Food and Agriculture ' says that the main problems facing the world's agriculture remain broadly the same. The basic dilemma of most governments is how to reconcile their dual responsibilities to maintain the economic position of farmers and at the same time to provide consumers with adequate food supplies at low prices. The deteriorating position of the farm population continues to cause anxiety. In spite of the added urgency caused by surplus stocks, only a beginning has so far been made towards reducing production and marketing costs

in order to bring more and better food within the reach of the poorer consumer.

' Although some progress has been made in adjusting the production pattern more closely to demand, there is little likelihood of any significant reductions in surplus stocks during 1956–57 ', says the report. ' Looking further ahead, much depends on the success of the new U.S. measures in curtailing output of surplus commodities. The relative stability of the present situation provides a further breathing-space for these and other measures to adjust world agricultural production '.

Mid-Wales investigation report

THE British Government's conclusions on the recommendations contained in the Mid-Wales Investigation Report have now been published as a White Paper. It considers that more stable conditions in rural Wales can best be promoted by ' well-equipped, economic farms and an extension of forestry'.

The report shows that, although many farms are being improved with Government assistance and some are increasing in size, others are being relinquished for afforestation, summer grazing or amalgamation with other holdings. In addition, there is still a substantial movement of population from the upland areas.

The Government agrees that rural economy should be assisted towards stability by the development of economic farms based mainly on cattle and sheep rearing, and that there should be no resort to compulsion. Already work amounting to £$3\frac{3}{4}$ million on the comprehensive improvement of holdings has been grant-aided, and powers to continue assistance of this type are being extended until 1963. The trend towards economic units will be encouraged by grants under the Hill Farming and Livestock Rearing Acts. Grant-aid will be directed mainly to those farms that are more suitable for livestock rearing and which have a reasonable prospect of economic stability. Smaller units which provide a useful entry to farming for the younger man will remain eligible for other grants.

The Government also agrees that there is scope for extensive planting by the Forestry Commission. Forestry, if properly integrated with agriculture, will greatly benefit the upland areas, for example, by providing shelter and timber for farm needs, by the exchange of labour, and by offering employment to more workers, acre for acre, than would pastoral agriculture.

There is already close co-operation locally between the Ministry of Agriculture and the Forestry Commission. An experimental farm has been established on which practical experiments in integration of forestry and agriculture will be undertaken. The Forestry Commission has accepted that the pattern of planting should be designed to provide the maximum of benefit to agriculture and, in the interests of hill grazing, will maintain fences, even when these are no longer needed to protect plantations. They have adopted the policy of housing forest workers in existing villages to strengthen community life.

The Government is paying special attention to the basic services. It is granting assistance towards the provision of houses and piped water supplies. Already rural water schemes, estimated to cost £8 million, have been approved. Electricity is being steadily brought to rural Wales and some 2,500 farms are connected each year throughout the Principality. Assistance is being provided for road improvement and maintenance.

The Government accepts that to secure the planned development of rural Wales further administrative machinery will be necessary to co-ordinate the implementation of policy. It is proposed to set up a small committee of senior members of Government Departments, resident in Wales, to carry out this task to ensure that action for the development of agriculture, forestry and basic services is pushed ahead. This new body will assist and work through existing public authorities and will report regularly to Ministers.

Farm safety

ACCIDENT incidence and prevention on the farm is, and rather strangely, a topic that is seldom discussed. Far more attention is devoted to accidents in factories. Nevertheless, modern farms today are highly mechanised and newspapers in agricultural areas report serious accidents on farms from time to time. As is well known in industry, fatigue is a common background cause to accidents—mental alertness is less sharp and even the normally careful worker can become accident-prone. An Iowa doctor, writing recently in the *Journal of the American Medical Association*, pointed out that the disappearance of genuine horse-power on the farm has raised the accident rate. Nor was his point the obvious one that tractors can, as machines, be more dangerously handled than horses. When the horse pulled harvesting or cultivating machines the horse itself had to be rested periodically. This meant that even at times of peak pressure in the agricultural year the farmer or farm worker had a rest as well. However urgent seasonal farm work may be, this U.S. doctor rightly insists that workers should take periodic breaks to avoid fatigue build-up (see Farm work study).

Mechanisation in Near East

WAYS of using machinery to help Near Eastern farmers to raise more food were examined at a four-week training centre which was held in Cairo recently. The Egyptian Government were co-operating with FAO in the sponsorship of a regional technical meeting and training centre on farm mechanisation, land development and workshop problems.

The aim of the centre was to enable senior personnel engaged in agricultural engineering work to discuss

organisational, management and operational problems connected with projects of farm mechanisation and land development. Participants studied the types of equipment suitable under various soil, climatic and operational conditions, as well as maintenance requirements and techniques.

Men holding supervisory posts in land-development work in their own countries had a chance to discuss their problems and experiences, to participate in technical discussions and to observe practical demonstrations of a wide variety of machines and techniques of operation and maintenance.

Many countries in the Near East are to some degree mechanising their activities under programmes of land development. Powered earth-moving and farming equipment is being used to prepare wasteland for farming and to supplement hand and animal labour in cultivating crops. Improved types of animal- and hand-powered tools are being developed at prices within the reach of individual farmers. But many of these programmes are handicapped by lack of experienced administrative personnel—the men who must plan the over-all programme, select and order the machinery, plan and equip workshops, and recruit and supervise staff.

It is hoped through the Cairo centre a greater knowledge of the preparation and facilities required at all levels of mechanisation programmes will help participating countries to avoid pitfalls which have sometimes been encountered in such programmes.

British machinery exports

ALTHOUGH the British agricultural engineering industry received a severe setback as a result of the Chancellor's measures in February, the sharp decline in sales has been stopped.

Export sales over the last six months show an increase of 8.6%, a small but not insignificant increase. It is of special interest that agricultural machinery exports to Australia have increased by almost 50% and there are notable increases in such markets as New Zealand and France. The outlook for the next 12 months appears to be encouraging, especially in view of the rise in trade that is likely to take place with South America.

This new situation must not, however, be viewed with undue optimism, for there is still no visible sign of improvement in home sales, reports the Agricultural Engineers' Association. The net effect of present developments is likely to be a reduction in stocks and this should help to place the industry on a firmer basis to face the increasing competition at home and abroad. Although Britain is maintaining a fairly steady turnover in most European markets, the contrast with Germany is striking because of the rapid increase in their share of the Continental trade. In Ireland particularly the British are feeling the full impact of German competition. Their figures show that export of British agricultural machinery to Eire during January–June 1955 was valued at £1,110,417, whereas during the same period in 1956 these have decreased to £819,397.

Urea–formaldehyde fertilisers

THE potentialities of polymerised urea–formaldehyde resins as fertilisers have been discussed and investigated now for almost 20 years. The ability of urea and formaldehyde to form long-chain molecules is one of the oldest exploitations of the plastics chemists, but urea, of course, contains a lot of nitrogen, about 46%. The nitrogen in urea is soluble and very quickly active; with the formation of condensed polymers through interaction with formaldehyde, the nitrogen becomes insoluble and much more slowly available in the soil. Thus there has always been the chance that slowly active nitrogen fertilisers, possessing the lasting virtues of organic nitrogen fertilisers like hoof and horn, could be made synthetically. Indeed, there have been a number of papers on this subject since the war and, in contrast with other agricultural chemical developments today, the commercial introduction of urea–formaldehyde fertilisers has certainly been slow. One reason for this has been the high demand for urea for making plastics, which has kept urea fairly scarce and also kept its price high. Fertiliser markets are not easily penetrated by costly chemicals.

In the U.S.A. significant commercial use began only last year, although field trials dated 1946 have been recorded. Several producers are selling 'urea-form' products, but at present only the domestic market for lawns and flowers seems to be within their price-reach. To some extent this follows the history of the nitrogenous organics; thus, when dried blood is very high in price, it is little used as a commercial fertiliser and only fastidious lawn owners and flower growers are willing to accept its cost. The on-costs of packaging in small units, of distribution and retailer's profit margin are relatively high in this market and this reduces the sharpness of differential between cheap and dear fertiliser materials. However, it is always a confession of economic weakness when a fertiliser—or any other agricultural chemical—is aiming only at this market. Producers seem hopeful, nevertheless, that 'urea-form' manufacturing costs can be appreciably reduced. Should this optimism be at all justified a much wider market can be attacked, notably the commercial vegetable and glasshouse sectors. At present organic nitrogen fertilisers are heavily used by these types of grower; the prices of organics fluctuate and so, to some extent, does their quality or, at any rate, their rate of nutrient release in soils. On level economic

terms a synthetic 'urea-form' product with a consistent rate of nitrogen release would present a severe threat to such materials as hoof and horn, dried blood, tankage etc.

So far there has been little more than experimental development in Britain, but it is possible that this new type of synthetic fertiliser may appear on the market soon. There, also, the domestic-use market will be the initial target. But in America the use of urea as a straight fertiliser has been established for some years; it would be almost paradoxical if in Britain the development of urea–formaldehyde products preceded any significant use of urea itself. But such a paradox seems likely.

Acreage doubled in decade

EUROPEAN farmers in Southern Rhodesia are reported to have doubled the amount of their land under cultivation during the past 10 years. In Northern and Southern Rhodesia together a total of more than 1,500,000 acres is now being tilled by Europeans.

The total value of the European output in Southern Rhodesia in 1954 was £40 million. In the same year the total value of all sales, both European and African, amounted to £53 million, but, in addition, the Africans in the Federation were estimated to consume about £17 million of agricultural produce. As a result of the expansion during the past 10 years the Federation now exports more food and agricultural produce than it imports—the credit balance amounted to £21 million in 1954.

Tobacco is, of course, by far the largest export item, accounting for five times as much of the Federal trade as foodstuffs. Although exported foodstuffs and animal, agriculture and pastoral products are worth more than £7 million, imports of those commodities amount to nearly £12 million, The major single items which the Federation is having to import are sugar, wheat, butter and fish.

Farm work study

AGRICULTURAL labour shortage is not confined to the U.K. The majority of Western European countries (Italy is an exception) are becoming acutely concerned at the position. It is generally agreed that one way of making more effective use of the remaining labour force, and providing better earnings for farm workers, is to employ work study techniques.

Representatives from 12 European countries have been meeting in Holland to discuss the subjects of work simplification and labour management on farms. The conference was organised by the Netherlands Ministry of Agriculture, Fisheries and Food on behalf of the European Productivity Agency (E.P.A.) of the Organisation for European Economic Co-operation.

Dr. L. H. Brown, an E.P.A. consultant and farm management extension specialist of Michigan State University, said that work study and labour management problems could be classified under six main headings: (1) balancing the size of the business with the labour force (many European farms are too small to provide a satisfactory level of productivity, whereas others can build up business by intensification or by increasing crop yields or livestock production); (2) improving seasonal labour distribution; (3) finding easier, quicker and more economical ways of doing farm jobs; (4) developing efficient methods of working with new machines and buildings and of planning new buildings; (5) reducing the physical strain in doing farm work; (6) maintaining good labour relations.

Initiation into work study for farmers appears to have been confined to the work carried out by the B.P.C. in the U.K., but in other countries agricultural advisers (corresponding to county and district advisers of the N.A.A.S. in Britain) have received instruction.

Probably one of the most controversial questions arising in work study is what allowance to make for fatigue. Prof. G. Lehmann, Director of the Max-Planck Institute, Dortmund, pointed out that the frequent change of activities in farm work causes a wider fluctuation of the energy expended on different working days than in industrial work. Demand may, on single days, increase by 30%, but this abnormal expenditure may be compensated by a corresponding fall on other days. He considered the question of rest-pauses a vital one in ensuring efficiency in production. Many workers interrupt their work ostensibly to make technical adjustments which are not necessary. Such camouflaged rest-pauses represent an actual loss of time, while genuine rest-pauses produce, in the long run, a gain of time.

Some of the more important problems of labour relations under discussion were: maintaining an equitable wage scale; furnishing good housing and providing good equipment (workers have the responsibility of looking after both); keeping reasonable hours; giving paid holidays and time off; maintaining a neat and safe work-place; training workers; planning work ahead; helping with unattractive jobs; being prepared to accept suggestions; praising a good job; and generally following the golden rule 'do unto others as you would have them do unto you'.

To sum up, it seems clear that agricultural advisers and research technicians are giving the application of work study to farming increasing attention. The technicians are treading warily and not trying to fog the issue with superlatives and jargon. In the final issue it is the farmer who will have to make the decision about accepting the results of work study. Probably, therefore, it will be necessary to spread the gospel among farmers by means of individual or group training courses. In this direction the U.K. has already set an example to other countries.

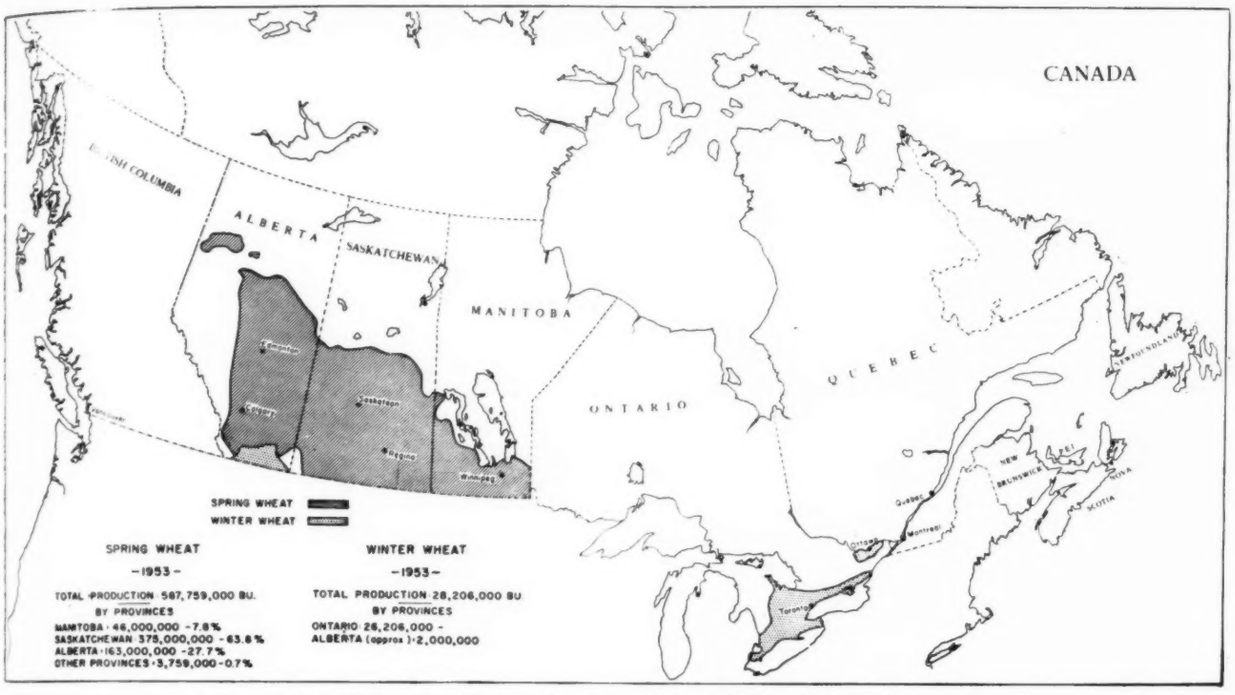


Fig. 1. Distribution of spring- and winter-wheat production in Canada in 1953

WHEAT BREEDING AND PRODUCTION IN CANADA

C. H. GOULDEN

(*Director, Experimental Farms Service, Canadian Department of Agriculture*)

Some of the practical problems in Canada's wheat - breeding programme are discussed in this paper. Soil types and climatic conditions play an important part in this programme. The author correlates the role of plant breeding in the fight to produce disease- and pest-resistant types and leads on to a summary of the practical value of plant breeding.

THE chief purpose of this paper is to describe very briefly the wheat-breeding programme in effect in Canada and to relate it to practical problems of wheat production. To do this it is necessary to take a brief look at the areas in Canada where wheat is produced, the types of wheat suited to these areas, and the particular problems arising out of soil and climatic conditions.

Fig. 1 shows the main areas of wheat production in Canada, spring wheat being indicated by shading and winter wheat by stippling. Data are included on total production in 1953 for Canada and for the principal producing provinces.

Fig. 1 also shows that practically all the spring wheat is produced in the Prairie Provinces (Manitoba, Saskatchewan and Alberta). The problems of spring-wheat production are, therefore, closely related to the climatic conditions of the Prairie Provinces and their geographical location. In the first place, the winters are long and cold and the summers short and warm, with long hours of sunshine. Spring wheats must be capable of rapid growth and maturity. Rainfall in general is low although in normal seasons there is a good distribution in that the heaviest fall is in the months of June and July. The area of lowest precipitation is, very roughly, in the form of a triangle which extends from the middle of the southern boundary of Alberta, north-east to Battleford, Saskatchewan, and then south-east on a line which passes about through Moose Jaw. Spring wheats for this area must have a degree of drought resistance. The dry triangle corresponds roughly with the distribution of the western wheat-stem sawfly and, consequently, spring wheats for the most of this area must have a measure of sawfly resistance. Along a northern strip of the spring-wheat area damage from fall frosts is always a hazard and in some years fall frost damage may occur in almost any part of the prairies. This emphasises again the need in the prairies for varieties of spring wheat that are early maturing.

TABLE 1
PRODUCTION OF DURUM WHEAT IN THOUSANDS OF BUSHELS FROM 1951 TO 1955 IN THREE CANADIAN PROVINCES

Year	*Manitoba*	*Saskatchewan*	*Alberta*	*Total*
1951	3,500	8,500	1,200	13,200
1952	2,300	7,000	850	10,150
1953	800	7,500	800	9,100
1954	400	4,600	1,600	6,600
1955	300	11,300	5,600	17,200

In Manitoba and the eastern half of Saskatchewan epidemics of stem rust and leaf rust are a continuing hazard and a definite requirement is resistance to these diseases. The effect of rust is to reduce yields and grade. In some years there have been reductions in the total crop of as much as 200 million bushels and the grade has been reduced to the point where the wheat is of use for feed only.

It is well known that in the Prairie Provinces of Canada spring wheat grown in the northern districts, particularly on grey-wooded soil types, is of lower protein and baking quality than the wheat grown farther south. The highest quality of wheat for milling and baking purposes comes from an area that corresponds roughly with the dry triangle. In general, there is a correlation between high quality and low yield. This poses a particular problem in Canadian spring-wheat production in that increasing yields by cultural methods or fertiliser treatments, or possibly even by plant breeding, may result in a slight lowering in the average quality. Extensive studies are now being planned to determine the effect of cultural practices on wheat quality in order that practices can be recommended that will retain the high quality of our wheat on world markets.

Durum spring wheat, which, until recent years, was grown quite extensively in Manitoba and south-eastern Saskatchewan, has also been subject to heavy damage from stem rust, and rust-resistant varieties are only now becoming available. During the past two years, 1954 and 1955, there has been a movement westward of the durum production, chiefly to southern Alberta and south-western Saskatchewan. It is expected that as the resistant varieties become available the durum production area will again swing back to Manitoba and south-eastern Saskatchewan, where the soil and climate seem to be well suited to growing this type of wheat.

Table 1 gives the production of durum wheat in thousands of bushels from 1951 to 1955 in the provinces of Manitoba, Saskatchewan and Alberta. The drop in production from 1951 to 1954 was largely due to the effect of stem rust, as the acreage in 1954 was 745,000 and, in 1951, 696,000. As production dropped there was a corresponding shift in acreage from Manitoba to western Saskatchewan and Alberta. This was an attempt to escape rust injury.

Fig. 1 shows that there are two distinct winter-wheat-producing areas in Canada. These are in southern Alberta and southern Ontario. In Alberta the great need is for additional winter hardiness. This is the greatest limiting factor in winter-wheat production. In fact, if considerably more winter hardiness could be obtained in a new variety, it is practically certain that winter wheat would displace a good deal of the spring wheat now grown in the dry areas. Of course, a successful winter wheat for the prairies must have wheat quality comparable to that of spring wheats and should have considerable resistance to the western wheat-stem sawfly.

Fig. 2. Marquis wheat stems infected by stem rust. This is a severe infection that will materially reduce yield and grade

Winter wheats for Ontario do not require the degree of winter hardiness that is a necessity for the prairies. Quality requirements also are very different from those in the prairies in that the Ontario winter wheat is grown for making low-protein flour for the biscuit trade. High yield and strength of straw are important factors as is resistance to loose smut.

Role of plant breeding

Breeding for rust resistance.—In most of the countries in which wheat is an important crop there has been a good deal of activity in the breeding of rust-resistant varieties. In North America, South America, Australia and Kenya stem rust caused by *Puccinia graminis* has caused the most serious losses, and obtaining resistance to this disease in the plant-breeding programmes has been the chief objective. In Canada leaf rust caused by *Puccinia triticina* is also destructive and in recent years plant breeders have been giving particular attention to obtaining resistance.

The early work on breeding rust-resistant wheats in North America was begun at the Minnesota Experiment Station under the direction of Dr. H. K. Hayes. At this time the plant pathologists at Minnesota, under the direction of Dr. E. C. Stakman, were discovering that the stem-rust organism consisted of a number of physiologic races differing in virulence with respect to varieties of wheat. Thatcher wheat was the first rust-resistant variety of good milling and baking quality to be introduced in the north-western U.S.A. and in Canada. It became widely distributed and is still the predominant variety in Canada, but not at present in the areas where rust epidemics are most common. Thatcher wheat is a very high-yielding variety and for this reason it displaced other varieties even in areas where stem rust is not usually a factor in wheat production. It is very susceptible to leaf rust.

Stem-rust trials

In Canada the first extensive breeding programme for stem-rust resistance was begun at the Cereal Breeding Laboratory at Winnipeg in 1925. This work was initiated in co-operation with the Laboratory of Plant Pathology at

Winnipeg and has continued up to the present as a co-operative venture between the plant breeders and plant pathologists of these two institutions. The Winnipeg laboratory introduced Renown in 1937, Regent in 1939, Redman in 1946 and Selkirk in 1953. Regent and Redman wheat became widely distributed in Manitoba mainly because of greater resistance to leaf rust than Thatcher, but were not quite equal to Thatcher in yielding potential and, therefore, could not compete with it farther west, where rust was not a factor.

In 1939 a race of rust was discovered in the U.S.A. to which Thatcher and all other previously rust-resistant varieties of wheat were susceptible. It is referred to as race 15B. The plant breeders at Winnipeg immediately began a search for parents resistant to this new race and discovered that a selection from a field of Garnet wheat made by a farmer in Manitoba was resistant. This variety has been named McMurachy, after the farmer making the selection, and has been used extensively by the plant breeders. As a result of the Winnipeg work, the variety Selkirk was produced and increased for distribution. The progress of race 15B was so rapid, however, that it became epidemic in 1954, one year before there was a sufficient quantity of Selkirk available to have any effect in preventing damage. Selkirk is now quite widespread throughout Manitoba and eastern Saskatchewan and there are abundant supplies of seed.

At present there are in existence strains of existing races of stem rust that can attack Selkirk wheat. The progress in breeding for resistance to these strains is, however, quite well advanced and resistant varieties are already in the testing stage. In varieties now being produced high resistance to leaf rust is also being incorporated with the objective of completely eliminating rust damage.

Sawfly resistance

Breeding for sawfly resistance.—The western wheat-stem sawfly, *Cephus cinctus*, is a four-winged insect which attacks wheat, rye, barley and some native grasses. When attacked by the larvae of this insect, wheat plants break off near the base and the heads fall to the ground. In severe infestations crop losses may be as high as 100%. In 1929 H. J. Kemp at the Swift Current Experimental Farm discovered that some solid-stemmed wheats which had been imported from New Zealand were not as seriously affected by the sawfly as the hollow-stem types. Breeding work was immediately initiated in order to transfer the solid-stem character to wheats of good yield and quality. As a result, a variety named Rescue was produced and was distributed to farmers in 1946. This variety is somewhat weak in the straw and has some quality characteristics that are not considered desirable. Further work resulted in the production of Chinook, which was distributed in 1952. This variety has somewhat stronger straw than Rescue and is of better quality.

Fig. 3. Test plots of cereals at the Central Experiment Farm, Ottawa. New varieties are tested extensively for yield and quality before licensing and distributing for commercial production

Owing to various problems that have arisen, an active breeding programme for the production of sawfly-resistant wheats is continuing. The work is now centred at the experimental farm at Lethbridge. The programme calls for the production of varieties with stronger straw, higher quality and yield, and with resistance to stem rust. The latter is required in the area which is between the rust area and the drought triangle. One interesting problem is that there are certain restricted sets of conditions wherein the sawfly resistance of Rescue and Chinook is not fully effective. This whole problem is of considerable importance to wheat production on the prairies and is being studied carefully in all its aspects by plant breeders, entomologists, plant pathologists, cytologists and plant physiologists.

Winter wheat

Breeding hardier winter wheats.—As pointed out above, the greater portion of the winter wheat grown in Canada is in the province of Ontario. The grain produced is used largely for the manufacture of pastry flour. The other winter-wheat-producing area at present is in southern Alberta. The amount produced is small because the winter-wheat varieties now available are not sufficiently hardy to live through the long, cold winters. The potentialities for winter-wheat production in the prairies, if suitable varieties could be produced, would be very great. The winter wheats could be expected not only to give higher yields than spring varieties under favourable conditions, but in drought years, when there is practically no rainfall after mid-summer, the winter wheats could still be expected to produce a reasonable crop.

For these reasons a breeding programme with winter wheats has been initiated at the experimental farm at Lethbridge, Alberta. At the same time, studies are being conducted on cultural methods and the effect of fertilisers in order to determine the effect that these factors have on winter survival. Since this work has only just started, it is not possible to report definite progress at the present time. Preliminary results, however, are somewhat encouraging. Plant-breeding and

cultural studies are being accompanied at the Science Service Laboratory at Lethbridge by fundamental studies on cold resistance and other factors affecting the survival of winter wheat.

Durum wheats

Breeding durum wheats.—At the Cereal Breeding Laboratory at Winnipeg there has been considerable activity in the breeding of durum wheats, although this work has not yet resulted in the production of satisfactory rust-resistant varieties. As in the case of common spring or bread wheat, it is extremely important that the quality of our varieties be maintained. Satisfactory tests for macaroni quality made from durum wheats have been worked out at the Grain Research Laboratory of the Department of Trade and Commerce at Winnipeg. Emphasis in durum wheat quality is chiefly on the colour and general appearance of the macaroni. These tests are now being used with considerable success for testing new material from the plant-breeding work.

Within the past year the durum wheat work at the Cereal Breeding Laboratory has been increased in scope. It emphasises rust resistance, strength of straw, high quality and yield. Strength of straw is another very important characteristic, as durum wheats in the past have tended to be weak and, therefore, subject to lodging damage.

Considerable progress in the breeding of durum wheats has been made by the plant breeders in north Dakota, and two new varieties produced there have been tested in Canada and found to be satisfactory in yield, quality and rust resistance. The names are Langdon and Ramsey. During the present season they are being increased at experimental farms for distribution to farmers in the near future.

Fundamental work

Fundamental studies. — All wheat breeders in Canada are fully cognisant of the importance of fundamental studies in genetics, cytology and other sciences having a bearing on the plant-breeding work. In the Federal Department of Agriculture emphasis is being placed on the practical aspects of the breeding work, but, at the same time, a good deal of attention is being given to fundamental problems. Fortunately, many of the fundamental problems are being studied by the universities, particularly in Manitoba, Saskatchewan and Alberta. For example, in the University of Alberta a study is being made of the location of genes for rust resistance and other important characteristics by means of monosomics (plants lacking one chromosome) and nullisomics (plants lacking one complete pair of chromosomes). At the University of Saskatchewan an intensive study is being made of the relation between genes for rust resistance in all known varieties having rust resistance. This involves making crosses between these varieties in all possible combinations and studying the behaviour of the segregating progeny. At the University of Manitoba a chair has been established for the study of fundamental problems in wheat genetics. One phase of the work being studied intensively has to do with the development of new wheat species by chromosome doubling and interspecific crossing. This is commonly known as species building.

In Federal laboratories the fundamental studies under way at the universities are being complemented and, in addition, attention is being given to other projects on which information is required. At Lethbridge plant breeders, plant pathologists, entomologists and cytologists are studying the western wheat-stem sawfly, how it affects the wheat plant, and how resistance to this insect is inherited. Others are studying the nature of winter-hardiness in wheat and methods of measuring it in wheat varieties and newly produced hybrids. In Ottawa a good deal of attention has been given to developing growth chambers in which environmental conditions are controlled so that plants for plant breeding and genetic studies can be grown throughout the entire year.

Practical value of plant breeding

Plant breeders would be very glad to be able to measure, with some degree of accuracy, the degree of progress they are making in increasing yields and improving the quality of the marketed produce. There are various reasons, however, why this cannot be done accurately. Some of these are:

(*a*) New varieties may actually change the environment. For example, new rust-resistant varieties may reduce the spread of rust to the extent that susceptible varieties are not seriously affected. A comparison of resistant and susceptible varieties is then not of much value in measuring the increase in yield due to the new varieties.

(*b*) Annual yield trends do not increase necessarily when new high-yielding varieties are grown. This may be because with the old varieties there might have been a reduction in average yield, or it may simply be due to the fact that inter-annual variation is so great that the effect of the new varieties is masked by other factors.

Certain generalisations from a study of effects over a considerable period of years can, however, be made.

Before 1910 the distribution of spring wheat was severely restricted in Canada owing to the lack of a suitable variety. Red Fife was commonly grown, but the losses from fall frosts were a deterrent to further expansion of wheat production. Marquis wheat, which was first distributed in 1909, then came into the picture and by 1911 was widespread in the Prairie Provinces. Its additional earliness as compared to Red Fife was sufficient to bring about a large increase in wheat acreage and just at a time when the economy of the country was in a position to benefit from the increased returns from agricultural production. Here, again, it would be difficult to demonstrate any increase in average yield in the area formerly growing Red Fife, but, in any event, the benefit in this instance was not only in increased yields, but in a wider distribution and use of the wheat crop.

Thatcher and Marquis

Thatcher wheat came in as the first spring wheat of good quality to be distributed in Canada and the north-western U.S.A. It soon became widely distributed in Canada. This variety has been in comparative tests with Marquis wheat in stations right across the Prairie Provinces since 1932. Defining a single comparison as a pair of yields, one of Marquis and one of Thatcher, in one year at one station there is, up to 1952, a total of 322 comparisons available for study. From these data some interesting observations can be made:

1. Total comparisons = 322 = 3,864 plots = 15,456 rod rows.

2. Taking the difference in yield as Thatcher yield less Marquis yield:

Fig. 4. Crossing wheat in plant-breeding plots. Pollen is transferred from one variety to emasculated florets of variety acting as female parent

(*a*) The greatest positive difference = 34.7 bushels, which occurred at Brandon in 1933.

(*b*) The greatest negative difference = 7.6 bushels, which occurred at Portage la Prairie in 1950.

3. The mean of all the differences is 5.27 bushels. Only 16.5% of the differences are negative.

4. Generally, the differences are greater at stations where rust is prevalent, but this does not hold for the stations at Lacombe and Edmonton, where rust was not a factor affecting yields.

5. It is estimated that, on about 20 million acres where Thatcher is suitable as a variety, the annual gain in yield from growing this variety as compared to Marquis is approximately 100 million bushels.

We now have the situation in the Prairies where Thatcher is no longer suitable as a rust-resistant variety because of the inroads of new races of stem rust, such as 15B. In the area where rust is prevalent Selkirk wheat, which is resistant to 15B, is rapidly becoming the predominant variety. It is also more resistant than Thatcher to leaf rust. It seems obvious, without elaborate tests, that total wheat yields are being held up to normal by this new variety.

New Animal Food

Experiments conducted on the farms of the Kenya Veterinary Department have shown the value of a substance called pyrethrum marc as a stock food for animals.

For many years the East African Extract Corporation have searched for a use to which the spent pyrethrum flower heads could be put after the pyrethrins had been extracted. Now, after extensive trials with both Merino sheep and high-grade Ayrshire cows, the spent flower heads—Marc—have proved to be a nutritious animal food. Analysis has shown percentages of both protein and carbohydrates equivalent to those obtained from good hay.

The total amount of pyrethrum marc produced is likely to be increased as world demand for pyrethrum extract increases. It is estimated that during the next three years 2,500 tons of marc per annum is likely to be made available as an animal food—a valuable contribution to Kenya's growing shortage of all kinds of stock feed.

U.S. Farms

There are fewer farms in U.S.A. today than at any time since 1890. U.S. farms now number 4,782,000. This is a drop of 600,000 farms since 1950.

Eucalyptus Widespread

Papers prepared for the October 1956 World Eucalyptus Conference indicated that eucalypt species have been planted on more than one million ha. of land outside their native habitat.

A paper presented to the Rome conference by N. A. M. Cromer of the Australian Division of Forest Resources says that, except in a few cases, countries which have planted eucalypts on a large scale have achieved the objectives for which the genus was introduced. Australia, the natural home of the eucalypts, has supplied seeds to some 26 countries anxious to grow stands for various purposes.

He said that successful planting programmes depend upon, firstly, an appreciation of the range of species available, the properties of their timbers, and the climates of their natural habitats, and, secondly, on a clearly defined objective for which the planting is proposed—a factor essential to the proper choice of species.

Mr. Cromer's paper was one of many that were presented at the conference. It is hoped that the conference, along with a study tour of Italian stands, will help more countries to realise the potential of the quick-growing eucalypts for easing local shortages of wood for domestic use.

Australian Machinery Exports

Exports of Australian-made agricultural equipment by Sunshine-Massey Harris for the year to 30 June reached an all-time record of £A1,115,000, the Managing Director of H. V. McKay Massey Harris Pty. Ltd., Mr. L. T. Ritchie, said recently.

The equipment went to South Africa, the U.K., Greece, Cyprus, Pakistan, India, Singapore, Indonesia, Pacific Islands and New Zealand. Trial shipments had also been made to the U.S.A. and Canada.

Items shipped included headers, combines, disk harrows, drills, rakes, binders, maize shellers, disk ploughs, potato diggers, scufflers, peanut planters and tine harrows.

South Africa was Sunshine-Massey Harris's most important oversea market for agricultural implements, and the keenest interest overseas was taken in agricultural plant invented and made in Australia.

Fig. 1. A typical Australian wheat harvest scene. During the five-year period 1951–52 to 1955–56 Australia had an average production of about 182 million bushels of wheat

WHEAT-FARMING DEVELOPMENTS IN AUSTRALIA

S. L. MACINDOE

(Principal Research Agronomist, New South Wales Department of Agriculture)

Several changes have taken place in the Australian wheat-growing scene in recent years and because Australia is one of the largest wheat-exporting countries it is not without interest that we see exactly what these changes are and what they represent. The author of this article gives much information on varieties, weeds, erosion, cultivation methods and other related subjects. Our knowledge is brought up to date on many aspects of the wheat situation in Australia.

AUSTRALIA ranks tenth among the world's wheat-growing countries. However, more than half of the wheat grown is exported, which places it third or fourth among the large wheat-exporting countries. The proportion of world export wheat provided by Australia is 12 to 15% of the total. Wheat is easily the most important crop grown and exported and is exceeded in value only by wool.

Reference to the graphs for acreage, production and yield (Fig. 2), expressed as an average of 10-year periods, shows a gradually increasing acreage during the century with a downward movement coinciding with the second world war, during which large wheat production was not needed and acreages declined steeply. An immediate postwar increase in acreage was followed by a further downward trend, areas falling from 14 million acres in 1947 to just over 10 million acres in each year from 1951 to 1955. It will be shown that this decline in acreage is part of a general change in pattern of farming, in which greatly increased attention is being paid to livestock, especially for wool and fat lambs. This trend is due primarily, and almost equally, to comparatively higher wool and meat prices, to the need to 'spell the land', and to the presence in certain areas of heavy infestations of skeleton weed.[1]

Production has in general moved with acreage, the movement being somewhat steeper than that of acreage during the first 40 years of this century, but with a pronounced decline during the second world war, during which production difficulties and two unfavourable seasons were experienced. During the five-year period 1951–52 to 1955–56 production again nearly reached a peak with an average of 182 million bushels. This is due to a spectacular increase in yield per acre, which over this period has averaged 17.45 bushels, as compared with earlier average figures of 12 or 13 bushels.

Although part of this increase in yield per acre from approximately 13 to 17.45 bushels per acre must be attributed to above-average seasonal conditions, it is generally conceded that there have been also radical changes in farming methods, which led to a higher level of farming and a more permanent and satisfactory agriculture. In the wheat belt generally farmers have recognised the benefits to be derived from wider rotations and from

the sowing of leguminous pasture plants in rotation with wheat. Actually much of the long-term benefit from this has not yet been felt, as only a small proportion of sown pasture-land has so far been returned to wheat production. The big increase in yields experienced must therefore be interpreted rather as the culmination of a gradual improvement in a number of farming practices, amongst which the trend to crop land only one year in three or even less frequently is a most important factor.

Changes in wheat areas

Australian wheat is grown mainly in southern, south-western and south-eastern Australia. In these areas the rainfall occurs predominantly in winter and the wheat is a 'spring' wheat sown in the autumn. It continues to grow slowly during the winter and matures rapidly in early or mid-summer, when temperatures rise steeply. The grain harvested is typically a soft, white wheat, although hard, white samples, often of very high baking quality, are also grown, chiefly in northern areas.

In New South Wales most of the wheat is grown in regions having a rainfall of 15–25 in., but in more southern areas, where winter rainfall is more reliable, it extends close to the 10-in. isohyet.

The reduction in wheat acreage in recent years has not occurred evenly in all parts of the Commonwealth. It has been shown by McLennan[2, 3] that, although there has been a marked reduction since 1949–50 in wheat sowings in all States except Queensland, the most substantial reductions have been in the Riverina (35%) and South-Western Slopes (46%) Divisions of New South Wales. On the other hand, there has been a quite significant increase in parts of northern New South Wales, Queensland and the more westerly or lower rainfall areas of Western Australia. In the case of Western Australia, this increase is due to the clearing for cultivation of more than half a million acres of new land during each of the last six years and the reconstitution of 700 farms previously abandoned in marginal areas.

The areas in which wheat growing has increased or remained static are those in which it has proved least easy to establish improved pastures. These are, in general, the lower rainfall zones or the more northern latitudes where subterranean clover (*Trifolium subterraneum*) is not easily established and where there is at present no altogether satisfactory replacement for this species, which is eminently suited for the more southern winter rainfall area of the wheat belt.

Increasing pastures and livestock

Almost all Australian wheat farmers are also sheep raisers. Their farms are in reality mixed farms on which livestock, pastures, and fodder production and conservation each play an important part. On a typical wheat-belt farm of 1,000 acres, 200 to 300 acres of wheat may be sown annually, and even before improved pastures are sown 600 to 800 sheep are usually carried. It has been known for many years that the stock-carrying capacity of such farms could be doubled or even trebled by the sowing of an appropriate strain of subterranean clover and Wimmera ryegrass (*Lolium rigidum*), so that the pasture value of the ley between wheat crops is raised both in quantity and quality. An increasing number of farms on which the major source of revenue was previously wheat now depend primarily on wool and fat lambs. This is bringing about changes in wheat farming in many areas which are more profound and significant than recent modifications in cultivating, sowing, harvesting and grain-handling techniques.

Although figures for all States are not available, it appears that the area

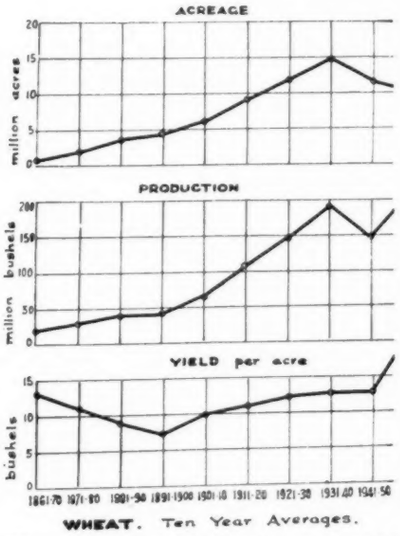


Fig. 2. Acreage, production and yield expressed as an average of 10-year periods

sown to grasses and clovers has more than doubled in the past decade, and much of this increase is in the wheat-growing areas. Sheep numbers have also risen during the five years ending 1954–55 from 112 millions to 130 millions. Fertiliser distributors and broadcasters, which are used primarily in pasture establishment and top-dressing, increased from 29,966 in 1945 to 44,058 in 1950, and a further substantial increase in later years is certain to have occurred.

The increasing areas sown to pasture on wheat farms have been made possible partly by a succession of above-average rainfall years, but also by the application of research findings. In Western Australia, for example, establishment of many subterranean clover pasture areas has been dependent on the use of copper and zinc in small quantities. In New South Wales larger dressings of superphosphate and good seasons have pushed the recognised subterranean clover areas into drier districts not previously considered capable of carrying improved pastures. Because of the large build-up of hard seed in the soil, a permanent extension of the subterranean clover areas is anticipated even when less favourable seasons return. Indeed, one south-eastern wheat district, which 10 years ago was considered marginal for subterranean clover, has in the space of five years become one of the main seed-producing areas, production during the past season reaching 1,500 tons of Government-certified seed. In restricted areas the use of molybdenum, of rhizobium cultures used on the seed, and of lime mixed with superphosphate, have overcome problems in the establishment and maintenance of improved pastures.

In the northern parts and in some dry, southern wheat areas, where subterranean clover fails to regenerate, medics, especially barrel medic (*Medicago tribuloides*) or lucerne, are being used to improve the grazing quality of the uncropped land and to raise fertility. Lucerne is often sown on wheat land at only 2–3 lb. per acre and frequently at the same time as the wheat.

At least two programmes of breeding subterranean clover are under way to produce types suitable to even drier parts of the wheat belt, or to combine more desirable leafy habit with the earliness of an existing strain such as Dwalgenup. In addition, a search is

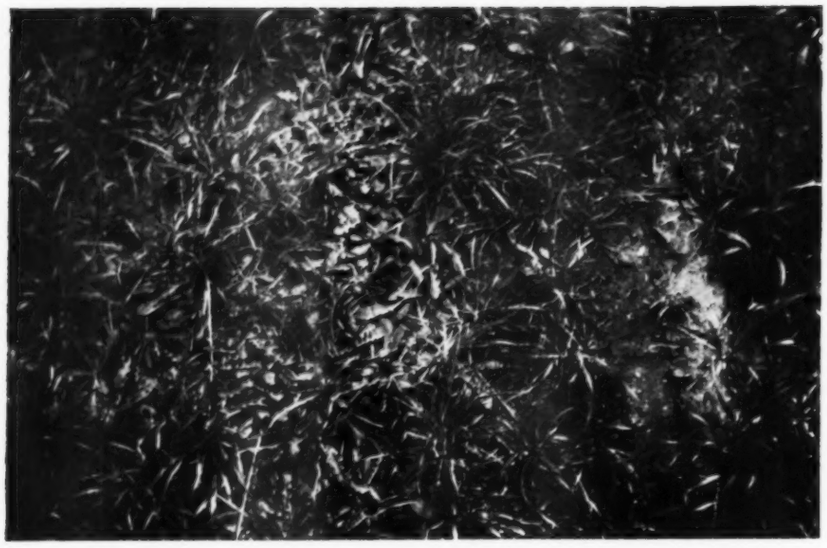


Fig. 3. Control of skeleton weed by 2,4-D extends into the second and later seasons. The area on the right was sprayed with ¾ lb. of 2,4-D 12 months earlier when spraying wheat. The area on the left where the weed is conspicuous was not sprayed the previous year

being made for other grasses or clovers which might be of value in the drier or more northerly areas where subterranean clover is not likely to succeed. An improved strain of barrel medic, known as 173, was also certified for the first time in 1956.

Pastures and weeds in wheat

In the southern areas of New South Wales, even before the price movement in favour of sheep, the perennial deep-rooting skeleton weed (*Chrondrilla juncea*) was forcing farmers out of wheat production. This weed is one which increases with cultivation and frequency of cropping, a factor in itself favouring adoption of wider rotations. As subterranean clover sown with the wheat crop became established on such lands thrown out of wheat production for several years, the pastures became equally, if not more, profitable than areas being cropped.

Effect of pasture

The annual winter-growing pastures also exert a smothering and weakening effect on the weed in the 'rosette' stage. This is not sufficient to control it and the weed still competes in the arable phase. However, applications of 2,4-D to the growing crops effect reasonable control, the benefits from such treatments being particularly noticeable in the crop following that sprayed. It is an interesting fact that the hormone spray is much more effective when applied in the presence of a growing wheat crop, apparently because of the additional competition provided by the crop (see Fig. 3).

In the other parts of the southern wheat belt the most important weeds being controlled by hormone spraying are wild turnip (*Brassica tournefortii*) and wild radish (*Raphanus raphanistrum*). In addition, in the more northern parts of the wheat belt the annual thistles are important.

It is estimated that 1½ to 2 million acres of wheat are now sprayed annually to control weeds in the crop.

Changing cultivation methods

In all except northern wheat areas, where short or summer fallows are general, good farming practice previously meant the use of a six to nine months' fallow and five years ago more than half the farmers continued this practice. This soil preparation period is being shortened in an increasing number of cases, owing to the desire of growers to make fuller use of the pastures for stock grazing before ploughing is commenced. There is evidence that following on several years of winter clover pasture soil nitrogen and physical condition may be so built up as to make the long fallow unnecessary in most seasons. Because of the value to stock of improved pasturage, shorter fallows following the ley period are considered more profitable even if some reduction in grain yield of the following wheat crop results. A summary by Sims[4] of information on fertility trends of some wheat areas and also the work of Cornish[2] suggest that by no means are all Australian wheat soils declining in soil fertility. In fact, although some do appear to be declining, others are static and again others have apparently increased in productivity.

Checking soil erosion

During the 1920s, following the opening up of much virgin land and the intensification of farming practices, soil erosion was evident in most of the rich farming areas throughout Australia. Early in 1930 it was realised that experimental work should be undertaken in mechanised control measures. Contour banks were used and advocated first in New South Wales, but the practice spread to all States in the Commonwealth. As the result of inquiries made in North America, special legislation was passed in 1938 in New South Wales and a Soil Conservation Service was set up especially to deal with soil erosion control in that State. In 1940 active work was commenced in Victoria, followed by South Australia and Queensland, and then at the close of the war years Western Australia took positive steps to control erosion (see Fig. 4).

All mainland States now have specialist officers engaged on soil-conservation activities and the administration of special legislation. Throughout the Commonwealth it is estimated that two million acres of good arable land have been treated by modern soil-conservation methods and are now in a safe condition. An important recent development is that landholders who formerly considered the problem too great for them to undertake themselves now appreciate that it is a matter of individual responsibility and are spending large amounts of their own money on reclamation work, an attitude which is also promoted by substantial tax concessions granted to landholders undertaking soil-conservation work on their properties. There are also various schemes for Government financial assistance by way of loans and equipment. It can be claimed that the present position is satisfactory and that Australia has taken positive steps to deal with the menace of soil erosion at a much earlier stage in her develop-

ment than other countries, such as the U.S.A. and South Africa.

Treatment of stubble

During the exploitive period of Australian wheat farming it was customary to burn the stubble so as to clear the ground for the next wheat crop. Although for some years at least larger crop yields may be obtained after burning, the trend is away from this practice. Sheep which are used to graze the stubble following harvest tread down much of the straw and if the land is to be cropped before the straw has rotted light diskings are used to incorporate the straw in the top 2 or 3 in. of soil only. Quite shallow workings are customary and there is much evidence to support their use in normally dry seasons.

Stubble mulching is not commonly practised, owing partly to practical difficulties of cultivating and sowing beneath the straw. The blade plough, the trash 'Culti-Seeder', the rotary hoe and the chisel plough are all implements being used to a greater or less extent to avoid straw burning. However, it is now considered that the wider use of subterranean clover pasture, grown for several years between crops, has reduced the undesirable features arising from the burning of stubble (see Fig. 5).

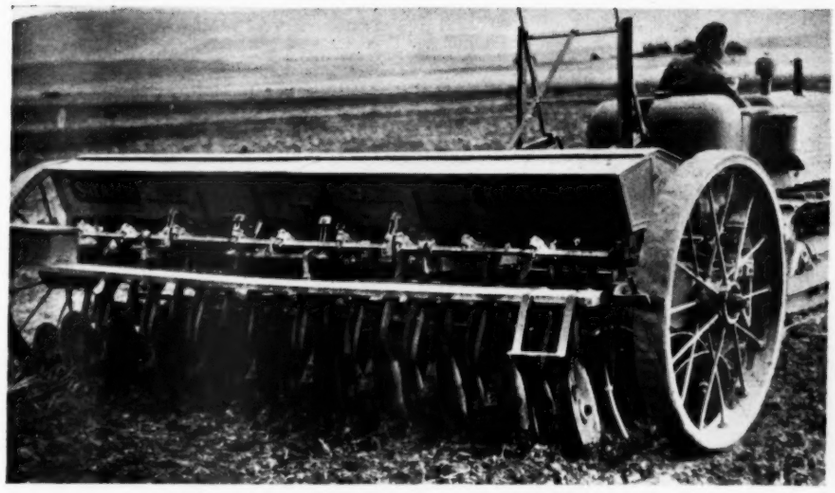


Fig. 5. Sowing wheat with a trash Culti-Seeder

Fodder conservation

Oats have for many years been grown in rotation with wheat. If the autumn and winter feed provided by pastures are inadequate, a major part of the oats is grazed by stock, the intensity of grazing being determined by the need for pasturage. The increasing tendency is to use more oats for grazing rather than for hay or grain. Wheat, especially in northern areas, is also grazed, but usually more cautiously so as not to decrease grain yields appreciably.

Fodder is seldom conserved in quantities adequate to meet the farmer's needs during a drought year, but some grain or hay is used to supplement seasonal periods of shortage of pasture. It is most often conserved in the form of baled cereal or pasture hay or as oat grain stored in galvanised-iron silos on the farm. Hay pressers and balers increased from 7,540 in 1946 to 11,018 in 1950. Oaten grain has largely replaced the wheaten and oaten hay previously cut with the reaper and binder and conserved in stacks, thatched or covered with a galvanised-iron roof. Wheat grain is also fed to stock, especially when surplus wheat is made available at concession rates for feeding to livestock.

[N.S.W. Soil Conservation Service]

Fig. 4. Run-off and soil-loss equipment at a soil conservation station. Water and soil loss are measured under different systems of farming

Rising costs

Ten years ago farms in the better rainfall areas were purchased largely on their value for wheat growing. Today a major factor in determining purchase price is stocking potential as estimated on the basis of the suitability of the property for pasture improvement. This has led to a doubling in costs, which on a 1,000-acre property would now approximate £23,000, made up of £12,000 for land, £3,000 for fencing and water supply, £4,000 for building home and sheds, £4,000 for farming plant, including tractor. To this would be added the purchase price for 500 breeding ewes of at least £2,000, making a total of £25,000.

It is costs comparable with these which now have to be met where returned servicemen from the second world war are being settled under the Government War Service Land Settlement schemes, which are designed to bring into more intensive use large

areas of privately owned grazing land of inherently high soil fertility.

Progress in mechanisation

So rapidly have farmers changed from horses to tractor power that the heavy farm horse is no longer a common sight. Tractors on rural holdings increased from 59,509 in 1945 to 187,192 in 1955.

For three or four decades wheat farming has been fully mechanised, except that the grain was still handled in bags from the paddock. In most wheat-growing States the bags were opened on arrival at country sidings, where they were received into bulk silos, whence it proceeded by rail in bulk trucks. Largely as the result of high prices and shortage of jute bags in recent years, many farmers changed quickly to handling their wheat in bulk from the harvesting machines (see Fig. 6). South Australia has continued to handle its crop in bags.

Combine harvesters or ' headers ' tend to become larger in size and power-driven. Many are now self-propelled (see also Fig. 7).

Larger tractors drawing multi-disk ploughs and cultivators are being used where areas warrant these. However, some mouldboard ploughs are still seen. Rigid-tine but stump jump scarifiers are available on most wheat farms and a special type of these, known as the chisel plough, is at present being widely publicised. This type, because of its strength of construction, can also be used to fracture the sod and, where necessary, to break a plough pan or handle stony or very hard soil. It can also be fitted with side-sweeps to permit of cultivation under the stubble.

Another implement which appears to be finding a place on the market is the ' Culti-Seeder '. This cultivating and seeding implement is capable of working through heavy stubble growth satisfactorily. Rotary tillage has been tried, but is not widely used in the wheat belt.

For fodder harvesting, power mowers, side-delivery rakes and automatic baling machines have increased greatly in number in the past few seasons. A locally designed and inexpensive forage harvesting machine has very recently been placed on the market.

Where skeleton weed and other weeds are troublesome, crops are being successfully sprayed, using low-volume, wide-boom spraying units or aeroplanes. In both cases much of the spraying is being done by contractors, but more farmers are purchasing their own boom spray equipment.

Better-yielding varieties

The pioneer wheat breeder, William J. Farrer, commenced his wheat improvement in 1886 and by the turn of the century varieties were being released which, within a few years, were of the utmost importance in extending the wheat belt into drier and more rust-free areas. Unfortunately, Federation, his main contribution as a practical wheat breeder, was not disease-resistant or of high baking quality, but it had other characters which were largely responsible for the quadrupling of the wheat belt in New South Wales between 1897 and 1915.

During the past 25 years further success has been achieved by the breeding of the following higher-yielding varieties, which in 1953–54 occupied the following percentages of acreage sown in the five wheat-growing States of the Commonwealth: Bencubbin 20.6, Insignia 12.2, Gabo 11, Quadrat 7.1, Bungalla 6.8 and Pinnacle 5.5.

It is estimated that during the 1940s the replacement in certain zones of Nabawa by Bencubbin and Bungulla added at least 6 million bushels annually to the harvests of Australian farmers. In Victoria it is considered, on the basis of plot yields, that varieties bred on Government stations have lifted yields by 12 to 15%. Unfortunately, of the varieties listed, only Gabo can be considered of satisfactory bread-baking quality. The quality of the other varieties is little, if any, better and in some instances is actually inferior, to that of Federation.

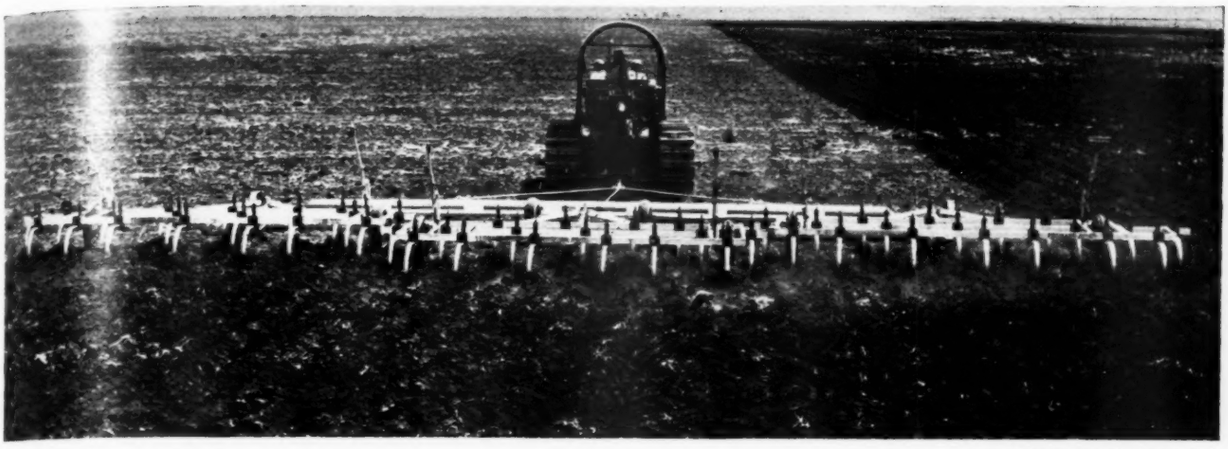
Breeding for disease resistance

In spite of active programmes of breeding for resistance to stem rust (*Puccinia graminis tritici*), a high measure of success has not been achieved owing largely to changes in the rust races present. Of the above-mentioned leading varieties, only Gabo was bred for rust resistance, but this, together with other highly resistant varieties, such as Eureka and Charter, have become at least moderately susceptible to the changed rust population. Among varieties which maintain a satisfactory resistance are Celebration, Festival and Spica, all of which are grown only in restricted areas mainly in the north. Parents from Kenya Colony, Egypt and U.S.A. have been the main sources of stem-rust resistance. The study of physiologic races of rust and the combining of different types of resistance are in progress at the University of Sydney. A back-cross programme undertaken to add stem-rust resistance to most of the standard wheat varieties was also only partially successful, owing to changes in the rust population.

Breeding for resistance to bunt (*Tilletia tritici*), using the back-cross method, has, however, been more successful, resulting in the production

[W. Porter Young, N.S.W. Dept. of Agriculture]

Fig. 6. A farmer empties his truck of wheat into his farm grain silos with an auger



[Queensland Country Life]

Fig. 7. A triple chisel plough, 66 ft. wide, operating on the Darling Downs in Queensland. It has been claimed that this is the largest known plough in the world

of such bunt-resistant strains as Javelin 48, Ridley 48 and Bencubbin 48, which are now undergoing trial or limited distribution to farmers. The majority of farmers are, however, still treating their seed to control bunt, using mercuric, copper carbonate or benzine hexachloride dusts, applied mainly by travelling contract seed graders.

In the late 1930s flag smut (*Urocystis tritici*) was considered to be the most important wheat disease in many wheat zones and because of its soil-borne character the very continuance of wheat growing in some areas was threatened. As a result of testing the disease reaction of a wide range of varieties, it was found that several, including Nabawa, Bordan, Dundee, Ford and Ghurka, had a useful measure of resistance to this disease. During the 1930s a revolutionary change occurred in the replacement of susceptible varieties, such as Federation and Free Gallipoli, by the above-mentioned resistant group. Important as was the yield improvement brought about by the replacement of Nabawa by Bencubbin and Bungulla, the substitution 10 years earlier of flag-smut-susceptible varieties by those which were resistant was vastly more important in stabilising or actually saving the wheat-growing industry.

Most new varieties released are now resistant to flag smut. This resistance appears to have remained stable in contrast to stem-rust resistance, which on at least three separate occasions has varied spectacularly, causing varieties bred for high resistance to stem-rust to become quite susceptible.

Better baking quality and cold resistance

Callaghan[5] recently reviewed the baking quality and market requirements of Australian wheat. He showed that, by 1952, approximately a quarter of the area sown to wheat was of inherently strong or medium strong quality as compared with a negligible fraction of about 4% 20 years earlier.

Considerable attention is being focused on the need to improve the baking quality of Australian wheat, which is used primarily for bread baking both locally and also overseas. Because of changes in baking techniques and the lower protein content of some other regularly imported wheats, British millers are tending to use less Australian wheat in milling their bread flours. Australian F.A.Q. (or fair average quality) wheat is, however, valued for certain desirable milling characters and is used for making domestic flours. Additional baking strength would enable it to reach the 'filler' standard for bread making.

Since at least 1931 higher baking quality has been an important breeding objective, and during the past 15 years a considerable measure of success has been achieved in the breeding of high-yielding and medium to strong baking quality varieties, such as Eureka, Gabo, Charter, Celebration and Festival. However, these varieties, with the exception of Gabo, are grown mainly in the northern wheat-growing zones, where one to five million bushels of high baking quality wheat are marketed annually at premiums ranging up to 3*s.* 6*d.* per bushel.

In some regions damage due to cold is considered the greatest single factor in reducing yield. Most of this damage is due to unusually cold nights following a relatively mild winter growing period, when the 'spring' varieties have not been adequately hardened. Premature heading may also occur during the winter, owing to mild growing conditions, when considerable damage can be caused to the stems of the young wheat plant or to the flowering parts, or to both.

Winter wheats

A programme of breeding 'winter' wheats capable of withstanding or avoiding these types of damage appears to be reaching a successful conclusion in the production of hybrids, of which seed is now being increased. The main source of the winter character is Winter Minflor. This is a winter selection from the local spring variety, Minflor. It is not as dormant during the winter as the typical winter wheats of North America, which have also been used in the breeding programme.

Recent books dealing at some length with the Australian wheat industry have been written by Callaghan & Millington[6] and by Watt.[7]

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The front mould-board of the van Damme plough turns over the top 3 to 4 ft. of soil, placing it in the bottom of the furrow. The rear mould-board then brings up 2 to 3 ft. of the rich soil uncovered by the front mould-board and places the rich soil on top of that turned over by the front mould-board. The board in front of the radiator tells the operator how deep the plough is running

The van Damme Plough

AS the people of the Netherlands pushed back the sea to get more land they came face to face with additional problems that had to be overcome before the ' new ' land could be placed in cultivation.

For example, to have rich topsoil on much of the 50,000 acres reclaimed from the Zuider Zee they had to replace the existing 3 to 4 ft. of sandy topsoil with a layer of rich soil which was covered by the sand. This proved to be as big a problem as that of draining the sea from the land.

The rich soil was needed for topsoil so the land could be intensively farmed. And it had to be intensively farmed if the cost of reclaiming the land were to be returned and additional food obtained for the increasing population of the Netherlands and for increased agricultural exports. The sand would support only pasture crops.

Hand labour

From test borings taken while the land-reclamation project was still in the planning stage, Government officials knew of the sand's existence and the problem it presented. However, they thought that with hand labour they could economically remove the sand, take out 2 to 3 ft. of the rich soil, replace it with the sand and place the rich soil on top.

This work got under way as soon as the land was drained in the early thirties, at a time when hand labour was plentiful in the Netherlands. But, after having finished only several acres with manual labour, the Government realised this method was proving to be too expensive and if the work was to continue it would have to be done mechanically.

In 1948, however, Mr. van Damme, a ditching and drainage ploughing contractor, developed a special plough that was mounted on the side of a track-type tractor. Geveke and Co., Caterpillar dealer in the Netherlands, worked with him during the plough's development by giving advice on selecting the right type of tractor, hydraulic cylinders etc.

The plough was built with two mould-boards, one drawn directly behind the other. The first one, however, was smaller and it picked up the sand and placed it in the bottom of the furrow.

Inverted soil

The larger mould-board, which went much deeper than the smaller one, picked up a layer of the rich soil lying beneath the sand and placed it on top of the sand in the furrow. In other words, the plough inverted the top 6 or 7 ft. of soil in one operation.

Mr. van Damme mounted his plough on the side of a Caterpillar D6 tractor. Consequently, it was found that another track-type tractor was needed to pull the D6 to keep it moving in a straight line.

The plough was mounted on a track-type tractor because the soil in the polders needing ploughing was soft, requiring excellent flotation of the vehicle upon which the plough was mounted. Then, too, Mr. van Damme felt the lugging ability of this type tractor, coupled with its traction, would keep the tractor from becoming stuck in tough spots.

Satisfactory results

The results achieved with this plough have been completely satisfactory. It has proved to be a means of economically and quickly converting areas reclaimed from the Zuider Zee, areas covered with deep sand, into areas which can produce ordinary quantities of a large variety of crops.

By the end of 1955 approximately 19,000 acres had been ploughed. It has cost about $320 to $400 an acre to plough the land—800 to 1,000 guilders per hectare. All ploughing has been done under Governmental direction, as has been allocation of land to farmers when a new polder has been completed.

After the land was ploughed, normal rains washed out any salt remaining from the sea. Crops grown include wheat, oats, rye, barley, seed potatoes, flax, sugar-beet, rapeseed and several varieties of peas. The crops first grown on the land after it had been ploughed were shallow-rooted crops not disturbed by any salinity remaining in the deeper soil.

Depending upon size, the ploughs vary in weight from about 4 to 5 tons. Most of the ploughing to date has been done in the Weiringmeer Polder in the northern part of the Netherlands. This polder contains 50,000 acres of land.

Copra Production by the Smallholder—I

F. C. COOKE

(*Director, Coconut Reseach Institute of Ceylon*)

One of the most important questions facing coconut growers today is 'Is it more profitable for me to sell my crops as nuts or as copra?' Naturally, the answer depends largely on the price. The small coconut grower who is in a position to make good copra or sell his nuts according to market demand, is in a sound independent position.

THE world market for low-grade copra is dwindling with the sensational and rapid development of the synthetic soapless detergents.

These synthetic washing powders and washing fluids are primarily products of the chemical, coal and petroleum industries and they are rapidly replacing soaps and soap powders made from animal and vegetable oils. Thus the demand will be more and more for high-grade vegetable oils for the manufacture of margarine, biscuits and cooking oils, and the preference will therefore be in favour of the edible grade of coconut oil. It is true that some acid, evil-smelling, off-coloured, low-grade coconut oil can be neutralised, deodorised and decolorised to make it suitable for edible purposes but additional processing and chemical treatment costs money.

In short, coconut oil is now more an edible oil than a crude soap-making oil. There is therefore likely to be a growing preference for dry white copra and the price discrimination against dirty, black, evil-smelling under-dried copra in remote and inaccessible areas is likely to increase until with a further fall in world prices it may again become unsaleable, as in 1933 and again in 1940.

Unsatisfactory position of growers

Smallholders and share-croppers are probably responsible for over 90% of the world production of coconuts but their economic condition is generally far from satisfactory, owing to their dependence on a single buyer—the village shopkeeper, the local miller, the landed proprietor or the money-lending trader. In fact many of them live in a state of permanent indebtedness and dependance, due originally to cash advances against crops for expensive social or religious functions.

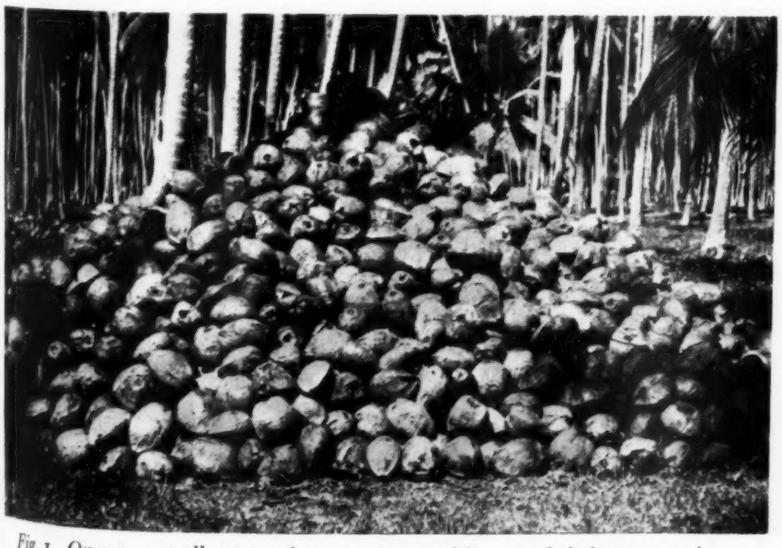


Fig. 1. On many small estates the nuts are stored in mounds before processing

To be in the fortunate position of being able to decide whether to sell his crop as nuts or as copra, he must own an efficient kiln and be able to make and sell white dry copra. This poses yet another problem. Many markets, particularly in remote rural areas, are at present organised only to handle low-grade, under-dried copra. The trader operates on the principle that all the copra which he is offered contains excess water and he pays accordingly. A producer of dry white copra may sometimes obtain a premium but it will generally not be adequate, because the quantity offered is commercially insignificant.

In such localities, there is need for some form of Government intervention. In the Philippines today the use of moisture meters in copra trading is now as obligatory as the use of an accurate weighing machine. This will make possible the imposition of a sound system for the commercial grading of copra and the production of dry white copra can then be adequately rewarded.

Nuts or copra?

One question the small coconut grower will have to be in a position to decide will be: 'Is it more profitable for me to sell my crops as husked or unhusked nuts (Fig. 1) or as copra?' The answer depends upon whether present demand is for desiccated coconut, coir fibre, coconut oil or for raw copra for export overseas. Sometimes also there is a special demand for white copra cups for use in temple

TABLE 1

True price of copra ex smallholding	=	Colombo price (Rs. *x* per candy), less Rs. 3/50 per candy (transport and handling charges from smallholder to Colombo)
True value of 1,000 nuts sold as copra by smallholder	=	True price of copra $\times \frac{1{,}000}{\text{out-turn,}}$ minus Rs. 4.50 per candy (cost of husking, splitting, curing and bagging)
Out-turn	=	Conversion ratio or number of nuts per candy
Candy	=	560 lb.
Rupee	=	1*s*. 6*d*.

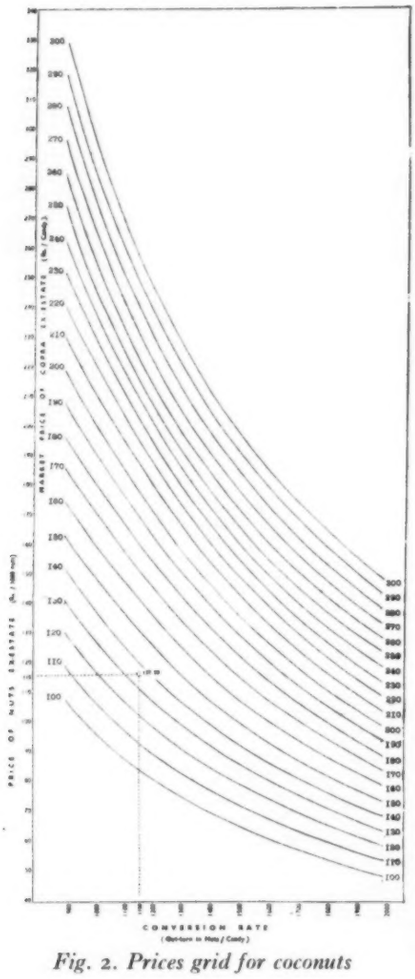


Fig. 2. Prices grid for coconuts

ceremonies or for dried white coconut as human food for use in sweets or biscuit-making, or as a 'sambal' or dressing for curry or similar meals.

Special demand varies according to market conditions and sometimes it may be wise to make and store copra. For long storage, it is absolutely essential to dry the copra to below 6% moisture.

A working definition for such copra is: The pieces are hard, crisp and break cleanly with a snap, exposing a sharp straight edge, having a uniformly pearly lustre. A thin sliver will readily ignite and will burn with a steady flame.

To determine whether or not at any one time it is better for the smallholder or his Co-operative society to sell nuts or copra it is necessary to make a few simple calculations as in Table 1.

Example:— When the quoted price of copra in Colombo is Rs.141 per candy, the true price of copra ex smallholding, is Rs.137/50, and if the copra out-turn for this smallholding is 1,150 nuts per candy, then the true value of the nuts when sold as copra is Rs.115 per 1000 (see Fig. 2). Therefore if the coconut grower is offered Rs.120 per 1000 nuts by the local desiccated coconut miller, he can accept the offer; conversely, if he is only offered Rs.110 per 1000 nuts he should convert his nuts into copra, if he has a kiln.

The transport and manufacturing costs will, of course, vary in different places and the out-turn or conversion ratio may vary from 900 to 2,000 nuts or more per candy. Using the graph, it is possible for anyone to decide at any price level whether it is better to sell as nuts or as copra (see Fig. 2).

Copra kiln for the smallholder

It is obvious that every coconut grower should not only own a small kiln, but he should also know how to make copra of good quality. The simple small copra kiln, described below, provides the answer; although it is primarily designed for use in smallholdings of 20 acres or under, it can also be used for decentralised production on small estates. This will save the cost of carting whole nuts to the central copra yard and the coconut husks and coconut milk are left in the field and returned to the soil.

The smallholder's copra kiln is, in fact, a Ceylon-type drier, considerably reduced in size and with improvements in design and operation to ensure that a better quality of copra is produced in only 2½ days or half the normal time.

Fig. 3 gives the front elevation, section and plan. The completed kiln is shown in Fig. 4. The hearth with its chain of burning coconut shells is shown in Fig. 5. It consists of two parallel lines of loose bricks with gaps to allow air to reach the fire. A heat spreader consisting of a piece of flat galvanised sheet 20 in. wide and 10 ft. long is nailed to the underside of the

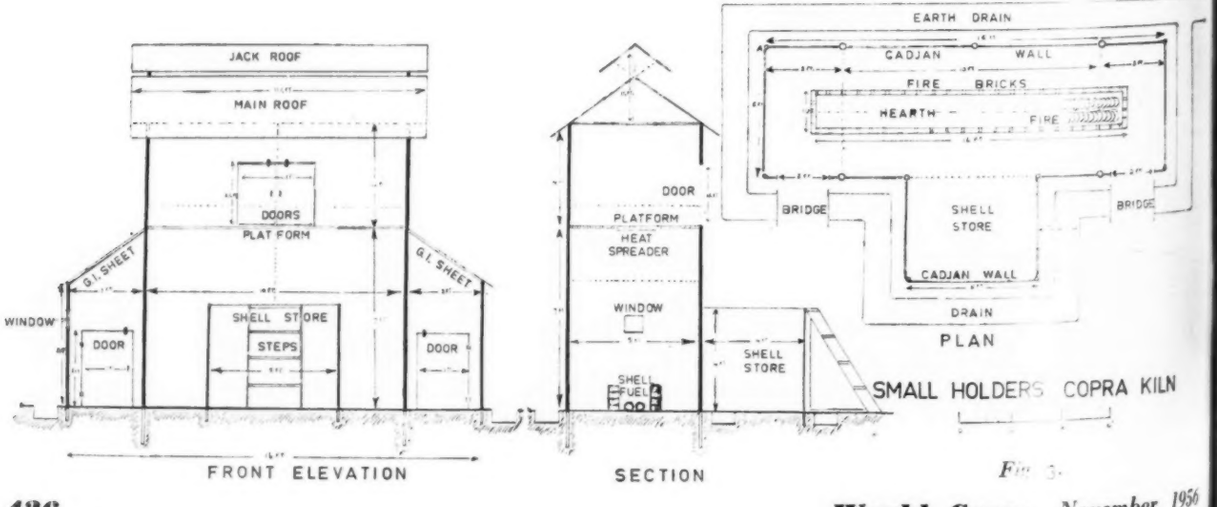


Fig. 3.

rafters to prevent overheating the copra immediately over the fire. The sloping cadjan roofs of the two wings are also protected from sparks by two flat sheets of galvanised iron on the underside.

The kiln is a simple structure made of cadjans (attaps or woven leaves), hardwood poles and light rafters. It has been so designed that the charge of 1,500 split coconuts is uniformly and continuously warm and as a result dry copra can be obtained in only $2\frac{1}{2}$ days without forcing the drying and without producing any scorched or case-hardened pieces.

Its design is based on the fact that the fire at the end of a chain of burning coconut shells produces an inverted cone of heat. When the copra platform is 7 ft. above the fire, the circle of heat is 5 ft. in diameter; this fixes the width of the copra platform or grill. The length of the copra platform is only 10 ft., because copra begins to deteriorate through the action of decomposing bacteria if heat does not reach it within four hours, which is the time taken for the fire point to travel from one end to the other.

Cadjan walls and roof are much better than corrugated iron or brickwork, because air can filter evenly into the firepit and there is no wind disturbance even on stormy nights; further, the kiln interior remains warm even on cold, wet nights and there is none of the moisture condensation and chilling and convection current disturbances that occur in the large Ceylon - type smoke driers during stormy weather (see also Fig. 6).

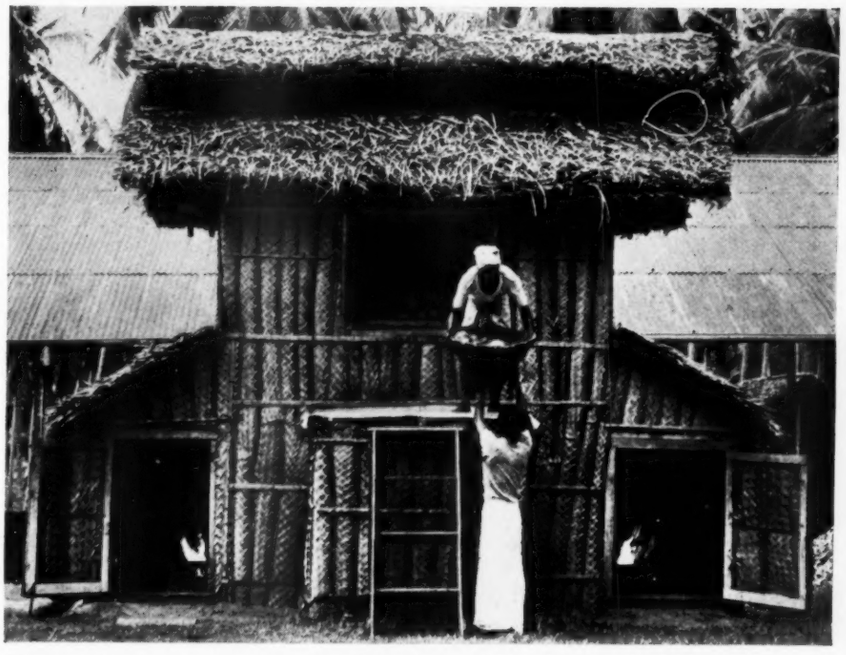


Fig. 4. A general view of the completed kiln. It is being charged with nuts. Both ends of the hearth can be seen through the open doors

Although cadjans or plaited leaves are very inflammable materials of construction, there is no risk of fire at all, providing the kiln is properly operated and no attempt is made to force the drying by providing additional or larger fires. On no account should firewood or husks be used as fuel, as this produces too much smoke.

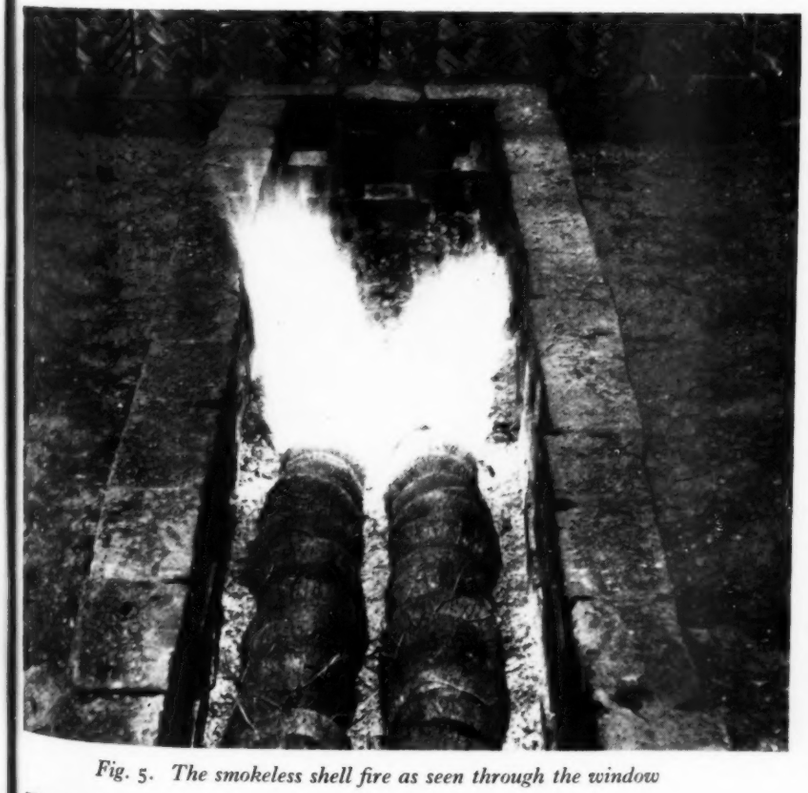


Fig. 5. The smokeless shell fire as seen through the window

Making the cadjans (attaps)

The cadjans or plaited coconut leaves are made from the fully-matured or necrosed brown fronds of the palm. The woody butt-ends are first cut off with a single stroke of a parang, machete, or cleaver, and these pieces are used as domestic fuel; the remaining portions of the fronds, consisting of the leaflets and the midrib, are taken to a water-hole, back water or shallow stream which has been dammed. About 1,000 leaves may be left to soak overnight (Fig. 7).

Early the following day the softened wet leaves are removed from the water and the fronds are bisected down the midrib by means of a knife or billhook mounted on a handle 3 ft. long. The operator takes hold of the leaflets with both hands, presses the centre of the midrib against the sharp cutting edge, steadies the knife with her left foot and pulls the leaf towards her,

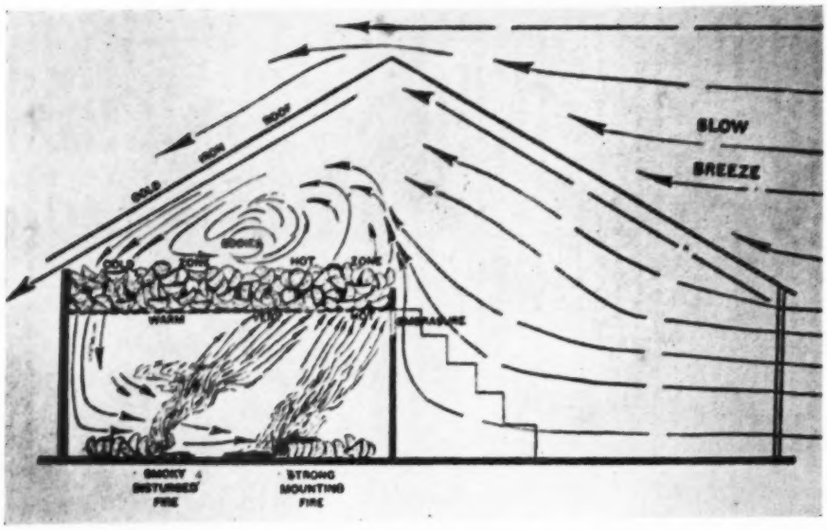


Fig. 6. (above) Irregular drying in an open small kiln, with open verandah and iron roof, during cold, rainy weather

Fig. 7. (below) The leaflets and the mid-rib of the palm fronds are left to soak overnight before the cadjans are plaited

TABLE 2

Materials	*Rs.cts.*
Hardwood poles, 13-in. girth, 103 ft. @ -/35	36.05
Coconut rafters, rough cut, 40 ft. @ -/16	64.16
Areca slats, 1 in. × ½ in., 978 ft. @ -/03	20.34
Wooden planks, various, 67½ sq. ft. @ -/75	50.62
Small rafters, 7-in. circumference, 96 ft. @ -/05	4.80
Door frames, 3 @ 5/00	15.00
Ladder or steps, complete	40.00
Cadjans or attaps, 325 double plaits at 5/00	16.25
Coir yarn, 50 skeins @ -/15	7.50
Galvanised-iron sheets, 4 @ 15/00	60.00
Galvanised-iron wire, 2 lb. @ -/80	1.60
Wire nails, 2 lb. @ -/80	1.60
Door hinges, 8 @ 1/25	10.0
Solignum, 1 gal. @ 3/00	3.00
Bricks, 80	3.60
Cement, 20 lb. @ -/10	2.00
Total..	Rs. 345.52
Labour charges	
For building framework, thatching, drain cutting etc., 14 days' work:	
Carpenter, 1 @ Rs. 5/- per day	70.00
Labourers, 2 @ Rs. 3/- per day	84.00
Total..	Rs. 154.00

thereby splitting the leaf into two halves. She can bisect 1,000 leaves a day.

Plaiting the halved leaves is naturally a much slower operation. The girls usually work in company, squatting on the ground and conversing happily. The leaflets are twisted and criss-crossed, starting from the base until a solid panel of plaited cadjan is produced. The finished cadjans are laid flat to dry in the sun. Each girl can plait about 50 split leaves to produce 100 cadjans per day.

These may be stacked in the shade of a palm and kept for several months till required or they may be used immediately. The 'life' of these woven cadjans is not very long; the cadjans used for thatching the roof may need to be replaced after a year, but those used for the walls of the kiln will last about two years, providing they are treated against termites with aldrin or chloradane or proprietary insecticides like 'Aldren' or 'Intox 8' are sprayed against the sides of the kiln.

Materials and cost

The full list of materials and their cost is given, together with labour charges, in Table 2.

Most of the materials are, however, available in rural areas and only a few items need actually be bought. To the smallholder, who is able to do things for himself, the cost, including new tools, need not exceed Rs. 50, £4 sterling or Straits $30/-.

The all-in cost, if all materials are bought and labour is hired, is Rs. 500/-, £40 sterling or Straits $330.

Part II will appear in the next issue

Argentine Wheat Prospects

Argentina will have 5,910,000 ha. under wheat in the 1956–57 season, according to estimates issued there by the Argentine Ministry of Agriculture and Livestock. This is 13.4% higher than the provisional estimate for the previous season when the area sown to wheat was put at 5,210,000 ha.

Advances in Spanish Agriculture

FRANCISCO JIMÉNEZ-CUENDE
(*Director-Gerente*, Agricultura, *Madrid*)

THE transformation of Spanish agriculture, which was vitally necessary to make up for the devastation caused by the Civil War, has been going on at an ever-increasing rate until the present time, when the realisation of all kinds of measures designed to increase agricultural production is yielding amazing results.

In the early days, owing to economic stringency and the need to obtain raw materials for the feeding of man and beast as well as for the agricultural industries, it was advisable to seek capital from manufacturing and trading groups which promoted certain agricultural products so that these, subject to proper controls and standards, might contribute to the promotion of new production vital to the economy of the country.

There have been many changes in the Spanish agricultural picture since the Civil War ended. At that time the country's agriculture was in a very poor state, but with the establishment, in 1939, of the National Institute of Colonisation much progress has been made in agrarian reform.

Increased production

Thus large sectors of the textile industry joined forces in order to intensify the cultivation of cotton, with the reward of being able to dispose of a large part of the fibres produced and thus to safeguard the normal operation of these industries.

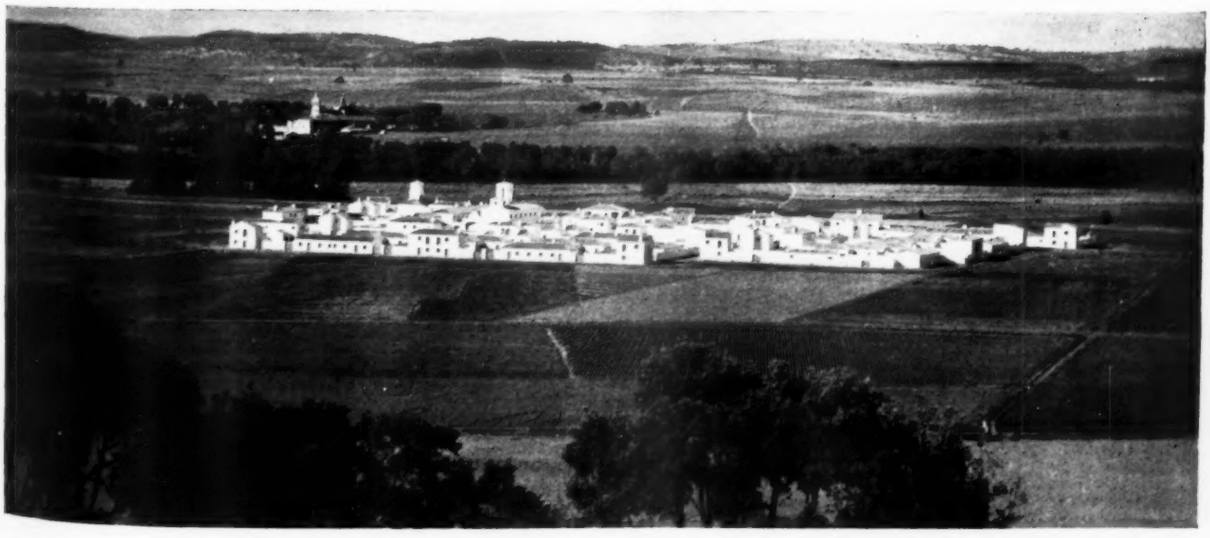
For a similar purpose, the silk industries joined forces. So did large breweries, anxious to intensify the cultivation of hops and thus to obtain the bulk of their vital supplies. As far as the seed trade was concerned, production units were formed for selected seeds in three vital branches—cereals and vegetables, horticultural plants, and seed potatoes.

The satisfactory results achieved by this policy can be appreciated from the following figures: Cotton, which, in 1939, merely comprised an experimental zone producing some 10,000 bales of 220 kg., has grown during the last campaign to a crop of about 200,000 bales, which covers more than 60% of the home consumption. This rate of progress can be maintained so that it will be possible to cover in the near future, *i.e.* within one or two campaigns, the total home demand for cotton fibres, estimated at 250,000 bales. The balance of the present maximum demand, which is of the order of 350,000 to 400,000 bales, must be covered by synthetic fibres made from eucalyptus wood and wheat straw. Both these industries are now in full production, so that the moment is very close at hand when it will be possible to dispense with all imports of this fibre, which used to represent one of the most important items in the trade balance of the nation.

Similarly, the production of hops has now reached a figure of 300,000 kg., large enough to cover the home demand, so that it has become possible to forego the import of hops which used to be obtained from Central Europe.

Seed production

Seed production has likewise shown a considerable increase. Among the horticultural plants special mention must be made of sugar-beet, the production of which has been stepped up so that it not only covers the complete home demand, but even leaves a considerable quantity for export even to such typical producer countries as Germany.



The new town of Agueda del Caudillo, near the Agueda reservoir, Salamanca

A magnificent olive tree at Velez-Málaga. In good years it can produce 300 to 400 kg. of oil

Irrigation

On the other hand, also in a time of shortages, the irrigation of extensive arid zones was taken in hand with the aid of capital provided by farmers, who were accorded special benefits (special premiums and the right to free marketing of their products), which during times of controlled markets compensated for the economic effort required for the catchment of the irrigation water and the preparation of the ground. In consequence, some 60,000 ha. of land were irrigated under this system. Among the cultivations deriving most of the benefit from this system was rice, which, originally confined to the river deltas and marshlands, has been extended to other zones that are otherwise unproductive because of the presence of great quantities of soluble salts.

Once the terrible consequences of the prolonged struggle had been mitigated and the worst shortages had been overcome, so that the rationing controls, which weighed heavily on the supply position, could be withdrawn, a new policy of crop control was effectively put into practice during recent years. On the one hand, this policy was designed to restrict those crops which might bring about an economic crisis and a collapse of prices, such as the cultivation of vines, or of fruits in recently irrigated zones, and the restriction, within certain limits, of the cultivation of sugar-beet.

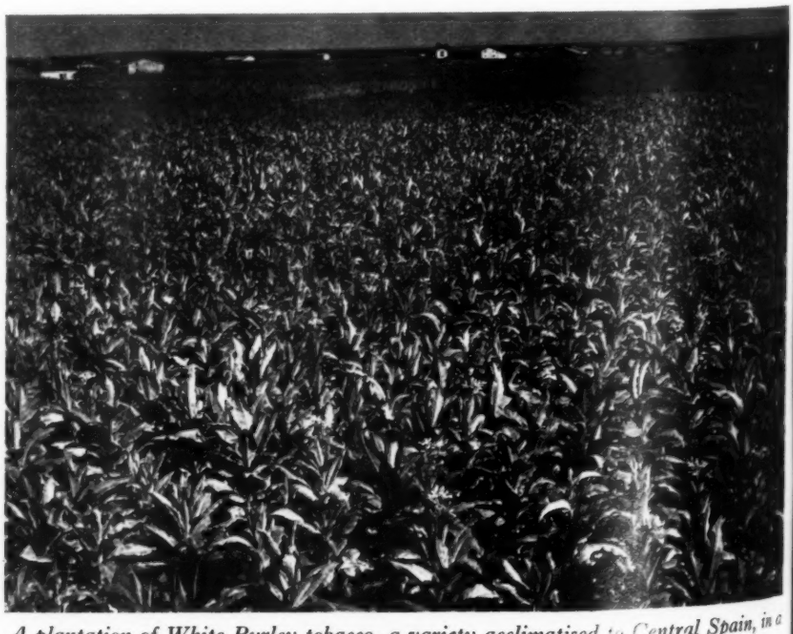
On the other hand, the cultivation of textile plants, especially cotton, has been stepped up. The cultivation of wheat has been extended with a view to safeguarding the food supply for the rapidly increasing population.

Olive plantations, representing a typical large-scale cultivation, which, in Spain, together with oak plantations, take the place of forests, are the subject of special attention with a view to avoiding, in years of poor olive crops, a deficit in fats; this deficit, in some campaigns, has necessitated the import of seed oil. In this connection special attention was paid to the extension of olive plantations in the arid zones of the south and of the Spanish Levant. The vast plantations now existing in the provinces of Granada and Malaga, added to those already in existence, will obviate the need for the import of vegetable fats referred to above and will at the same time arrest the erosion of those zones that are almost bare of vegetation.

Similarly, it is necessary to mention the increase in the cultivation of tobacco, which now completely covers the home demand since 20,000 ha. have been put under cultivation in the different zones, so that it is possible to cultivate the varieties best adapted to their average conditions. These varieties are acclimatised by the National Board for the Cultivation of Tobacco, which, in its modern fermentation centres, carries out the processing in accordance with formulae supplied by its research and testing centres.

Mechanisation

Concomitant with this crop-control policy, and at the most rapid rate during recent years, Spanish agriculture has been mechanised to an extent hitherto unknown, using a considerable quantity of the most modern tractors and agricultural machinery. This fact, combined with the cultivation methods employed, with the increase in the use of manure, and the use of selected seeds, has led to the desired result of increasing the specific output, which, in a climate as difficult as that prevail-



A plantation of White Burley tobacco, a variety acclimatised to Central Spain, in a newly irrigated area served by the Rosarito reservoir

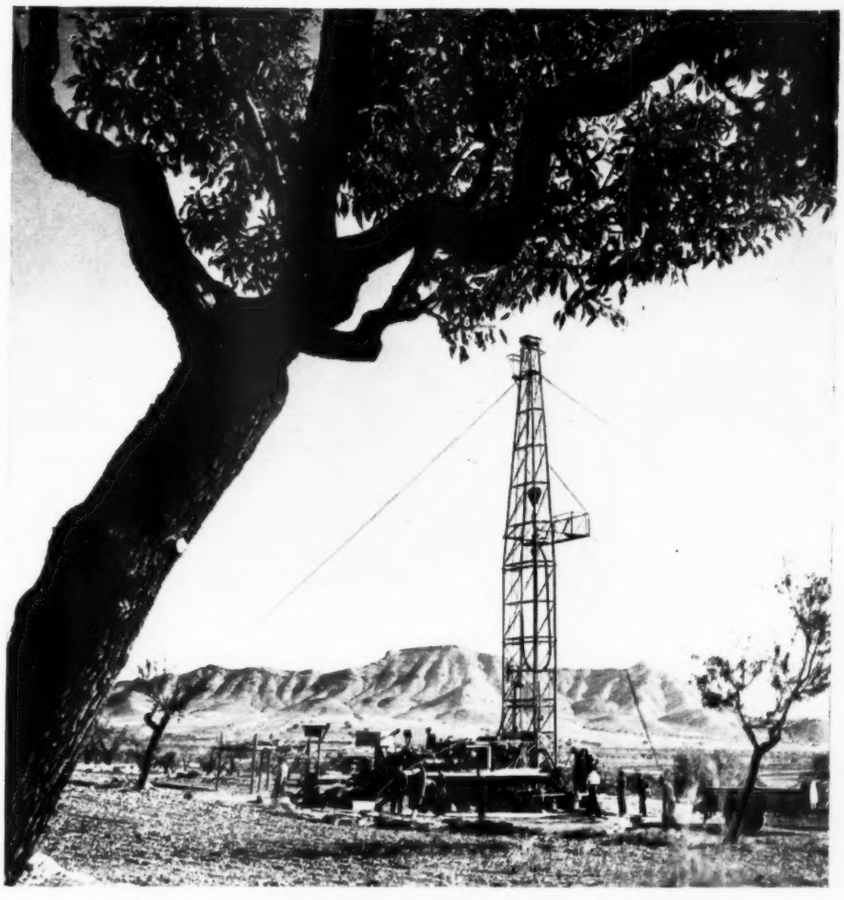
ing in many agricultural zones of Spain, is an indispensable condition if it is desired to compensate, at least in part, for the climatic drawbacks which have such an influence on the quantity and quality of the crops.

Colonisation

The agrarian reform is entrusted, as a main duty, to the ' National Institute for Colonisation ', which was established in 1939. The Institute operates in the regions, zones and estates, prompting or supplementing the private initiative to the extent needed to solve the complex technical, economic and social problems. Its colonising activities are carried out in the zones under irrigation as well as in arid zones which are insufficiently exploited, and in tidelands and marshes.

It is, however, not surprising that the colonising activities are mainly concentrated in the large zones under irrigation. This is because, on the one hand, it is desirable to reap early benefits from the large amount of capital that the State has invested in hydraulic engineering works designed for irrigation purposes and, on the other hand, because the zones concerned are those that offer the best technical and economic conditions and thus permit the early settlement of the greatest possible number of families. This is helping to overcome the agrarian social problem.

At present the operations of the Institute extend over 930,287 ha. of land, divided as follows: irrigation, 644,282; drainage, 45,965; parcelling of land, 240,033 ha.



Preparations in Alicante for searching for underground water

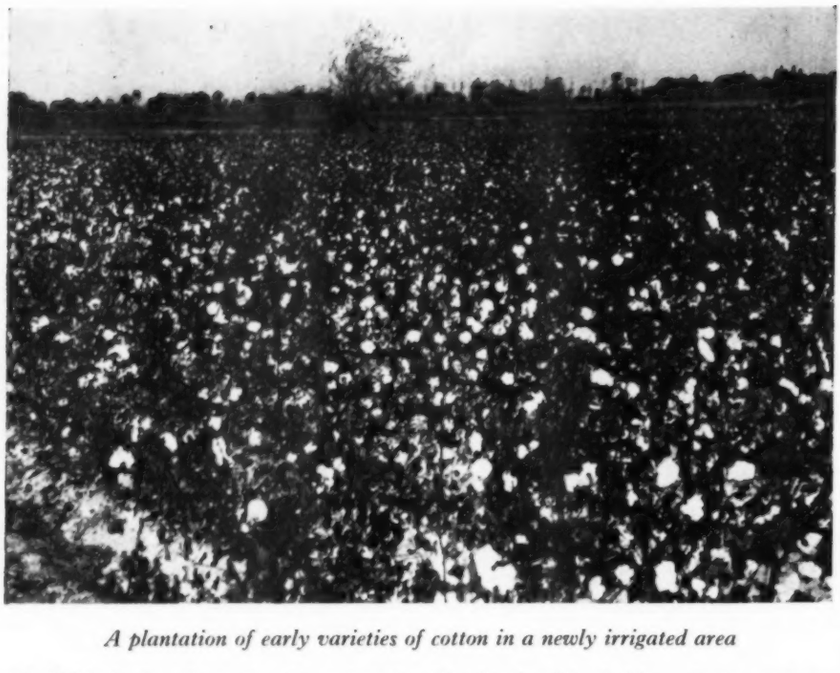
In zones of national importance the Institute is responsible for carrying out the supplementary works for the irrigation of the entire areas concerned (including all the secondary irrigation, drainage, roads, levelling of ground etc.) and the actual colonisation work (construction of villages, establishment of smallholdings, plantations etc.) exclusively in those parts of these zones which are directly colonised by the Institute. The remaining parts continue in the possession of the original landowners, who are, however, under an obligation to comply with the conditions laid down by the General Colonisation Plan in regard to the general rules to be followed.

Irrigable land prepared by the powerful equipment available today from the Instituto Nacional de Colonización

Area

The area directly colonised by the Institute on its own land amounts to 313,260 ha., which, according to origin, is divided as follows: 207,621 ha. acquired from voluntary sellers; 81,013 ha. acquired by compulsory purchase for overriding reasons of national interest; and 24,226 ha. acquired as land in excess of the zones under irrigation.

The colonising activities are completed by the selection and establishment of smallholders and their families for the colonised areas, the acquisition of livestock and agricultural machinery for these smallholders, and social aid



A plantation of early varieties of cotton in a newly irrigated area

of all kinds for them, in the cultural sphere as well as in the sanitary, religious and professional spheres.

This establishment requires, in the great majority of cases, and especially in zones recently irrigated, the solution of the problem of suitable dwellings. For this purpose new villages are constructed, comprised of dwellings and agricultural buildings of the smallholders whose lands are situated in the vicinity of the new village, as well as the community buildings and public services required to enable these new population centres to live a life of their own.

At present the dwellings already constructed or in a more or less advanced phase of construction include 112 new rural population centres, placed on a firm and safe economic basis, a total of 32,997 smallholders having been settled in this way.

In order to complete the task of raising the standard of living of the population by the methods explained above and at, the same time, to preserve and increase the fertility of the soil, a point is made of promoting the cultivation of those plants which, being suitable for the feeding of animals, lead to an increase in Spanish livestock and its products.

Pastures and stock

For this purpose regulations have been issued which compel the smallholder, in accordance with local conditions, to cultivate a certain part of his land with fodder plants and to keep a given number of cattle per hectare.

As the Ministry of Agriculture is aiming at an increase in livestock and animal by-products, and as meadows and pastures are vital for this purpose, it is important to improve the production of cattle fodder.

In Spain this is not a difficult problem in the humid and sub-humid regions, where large areas of mountain zones do not, for topographical reasons, permit of any other cultivation. But this does not apply to the arid zones where the permanent pastures are formed by a vegetation of the semi-desert type. These pastures, which have a low value for cattle grazing, have been, and in many cases still are, exploited excessively so that they are now in a poor condition.

The Ministry of Agriculture is now running a campaign to advise the smallholders in the different provinces, according to the local conditions, with a view to improving the various types of meadows and pastures, both those with indigenous vegetation and those using seeding techniques. Advice is given on the type of manure, on the most suitable species and on flock tending. Livestock has been imported from Portugal, Chile, North America, Uruguay and Australia.

This outline of the situation of Spanish agriculture may convey an overall impression of the intensive transformation that Spanish agriculture has undergone during the last 15 years or so, especially since rationing controls were abandoned and it became possible, with certain crops, capable of safeguarding the normal supply. It has been possible to direct the economic and technical effort, apart from increasing the efficiency of traditional cultivation, towards the establishment and promotion of other crops, such as those required for industrial purposes and which permits the progressive industrialisation of the country that is so important for the equilibrium of our agricultural economy.

Scarcity of New Farming Land

More than 100 would-be farmers and ranchers have been disappointed in Southern Rhodesia this year because the demand for Crown land in the European area of the colony is far outstripping the land available for settlement. A spokesman of the Southern Rhodesia Department of Lands said in Salisbury recently that suitable land in the colony for the establishment of new farms and ranches was becoming more and more difficult to find.

Since the war a certain amount of Crown land in the European area had been alienated each year by the Southern Rhodesia Government for the establishment of new farms and ranches. Land was allocated on a strict priority basis, with Rhodesian ex-Servicemen with five years' farming experience at the top of the priority list. The position of other Rhodesians on the priority list was determined by the length of their residence in the colony and by their farming experience. British ex-Servicemen with farming experience, other British subjects with farming experience and people with no farming experience came lower down the list.

The spokesman said that 193 people had applied this year for about 60 farms or ranches advertised by the Government last December. Of those who had gone disappointed, many were men with considerable farming experience who had lived in Rhodesia a number of years, but not long enough to qualify them for inclusion in the top categories.

Crop Protection in Yugoslavia

R. W. MARSH

[*Agricultural Officer (Temporary), F.A.O.*]

At the request of the Yugoslav Government the author of this note was sent by FAO, for the period April–June 1956, to report on the organisation and practice of plant protection in Yugoslavia.

IN the last five years, readers of WORLD CROPS have had the changing picture of Yugoslav agriculture put before them by de Fellner (1951, **3**, 485; 1955, **7**, 469), Gordon (1955, **7**, 320) and Krašovec (1956, **8**, 153). These articles agree in stressing the preponderating importance of agriculture and forestry in the Yugoslav national economy. In 1955, exports of timber from Yugoslavia were valued at 14,000 million dinars and those of agricultural products at 17,000 million dinars.*

Yugoslavia, however, still has a serious adverse balance of trade: her total exports in 1955 were 77,000 million dinars; her imports 132,000 million. Included in these imports were 975,000 tons of wheat and 36,000 tons of fat. The disconcerting feature of this situation is that Yugoslavia before the war was, on balance, a food-exporting country but is now a net importer of foodstuffs. Also, with a larger proportion of town-dwellers in the population, the output of food per head has fallen to two-thirds of the prewar figure.

The necessity for increasing food production is apparent, and, as shown in the earlier articles in this journal, the urgency is appreciated by the Yugoslav Government, who have this year allocated 18,000 million dinars for agricultural development. The factors now limiting output are many and varied—they include fragmentation of holdings, a lack of drainage, farm equipment and fertilisers, and a taxation system that bears heavily on the private producers—but it is obvious that pests, diseases and weeds play a major part in reducing yields in agriculture and forestry.

* The figures given in this article are taken from the *Statistical Pocket Book of Yugoslavia*, 1956, published in Belgrade, March 1956, by the Federal Statistical Office. £1 sterling = 840 dinars.

Fig. 1. A sketch map of Yugoslavia

Principal problems

A third of the valuable hardwood forests in Yugoslavia were manaced in the spring of 1956 by caterpillars of the gipsy moth (*Lymantria dispar*). In such forests, the intensity of attack is brought home to the observer who hears the incessant patter of the droppings from the caterpillars and watches the fragments of tattered leaves continuously drifting down like snowflakes. Equally spectacular are the locust invasions in Macedonia and south-eastern Serbia. Yugoslavia has 58 million plum trees and at least a quarter are now attacked by the šarka virus, which renders the fruit inedible, even by pigs. The parasitic flowering plants, dodder (*Cuscuta* spp.) and broomrape (*Orobanche* spp.), which are relatively rare in England, infest thousands of acres of clover, sunflower and other crops. Scale insects on fruit are so common that it is unusual to see an apple unmarked by them.

In addition, the usual pests and diseases of Western Europe such as Colorado beetle, potato viruses, cereal smuts and codling moth, together with the common farm weeds, are everywhere apparent and frequently flourish unchecked.

In contending with pests, diseases and weeds, Yugoslavia is not without assets in men and materials. There are long-established departments of agriculture and forestry in her universities, particularly in Belgrade and Zagreb, with a high reputation for research work and effective courses of training in plant protection. At Šabac and Zagreb are rapidly-growing chemical works and at Maribor a spraying-machine factory is now producing 600 motor sprayers and 1,800 barrow-pumps annually. There are ample supplies of home-produced copper, mercury, arsenate and nicotine. Yugo-

slavia, however, has no sulphur, and is also importing DDT, BHC and the selective weedkillers.

The adoption of crop-protection measures is at present very uneven, as might be expected in a country with such a diversity of terrain, peoples and farming methods. In general, the vines and hops are everywhere carefully sprayed and the attacks of downy mildew are kept under control. In fact, it is claimed that copper is often wasted in the vineyards, and a spray warning service is being developed to obviate unnecessary applications. In some of the fruit-exporting areas, pest and disease control is at a level little inferior to the standard reached in England. The apple orchards around Resen in Macedonia, for example, are sprayed six to eight times annually, and equal care is taken in the apricot-growing areas near Subotica and the peach orchards of the Smerderovo district. The State farms, and the beet fields around the sugar factories, are commonly well supplied with machinery and receive adequate spraying treatment against pests, diseases and weeds.

There remains the great mass of privately-owned small holdings, from 1 to 20 acres, which account for 70% of the total agricultural production. On these, crop protection has yet made little impact. To the problems of lack of machinery, poor communications and absence of instruction there are added—particularly in the southern regions—a rate of illiteracy up to 30% and the religious objections to taking life which are held by some of the Moslem population.

[Courtesy of Yugoslav Embassy, London

Fig. 3. Knapsack spraying of vines

Organisation

In a revulsion from their immediate postwar epoch of centralisation and bureaucracy, the Yugoslavs have adopted a drastic system of decentralisation. As part of this system, the Ministry of Agriculture was abolished and the administration of the agricultural services was delegated to People's Committees in 107 administrative districts, each roughly half the size of an average English county. Each district has set up within the past two years a Plant Protection Station, but many of these Stations consist at present of only one or two rooms with a staff of two or three newly trained plant pathologists, usually with little equipment or transport. The funds are provided chiefly by the District, and the Stations are frequently encouraged to become as self-supporting as possible by undertaking contract spraying for payment. In Croatia, particularly, the Union of Co-operatives also plays an important part in the provision of agricultural advisory services.

[Courtesy of Yugoslav Embassy, London]

Fig. 2. Incising opium poppy heads in Macedonia

Education

Recently a movement back to the co-ordination of the crop-protection organisation has been gaining ground. A Federal Plant Protection Board in Belgrade has been given power to take measures against dangerous widely distributed pests, which are now the subject of compulsory orders, enforced by inspectors who are stationed as required in the districts where infest-

ation is serious. The Federal Plant Protection Board has enlisted the help of the Yugoslav Air Force (whose selected pilots are given courses in insect biology) to carry out a bold campaign of air spraying against gipsy moth attacks. Other compulsory measures are in force against locusts, Colorado beetle and the fall webworm (*Hyphantria cunea*).

The six republics making up Yugoslavia are now increasing their supervision of plant protection activities within their boundaries. Republic Secretariats for Plant Protection are being set up and these administer some of the funds allocated by the Republic Chambers of Agriculture for agricultural improvement.

Future prospects

In the dynamic administrative atmosphere of Yugoslavia, where sweeping changes of policy can take place overnight, it is dangerous to prophesy future developments. The present indications are that the co-ordination of the plant-protection services is likely to spread, with Federal and Republic direction infiltrating into the District organisation. There is a particularly widespread interest in the modern methods of weed control, and, with the wide range of crops grown in Yugoslavia (including rice, cotton, hemp, tobacco and opium poppies as well as the more conventional crops of Central and Western Europe), much more knowledge is needed of the ranges of efficacy and safety of the selective herbicides. A weed-control research station and information centre would be of much value not only to Yugoslavia but also to her neighbours in south-eastern Europe.

A major problem is the dissemination of information on crop protection to the small-holders who make up two-thirds of the population. Some are in co-operative selling organisations, through which the advice of the few hundred plant-protection advisers in Yugoslavia can be disseminated. For the remainder, the long-term prospect is the improvement that will come through the activities of an ever-increasing number of agricultural schools. As the students from these schools return to their homes, they take with them a knowledge of the value of plant-protection. This knowledge is percolating to all parts of a country whose agriculture holds immense possibilities of development.

Soil Injector

We regret that the implement illustrated on p. 388 of the October issue was wrongly described. The caption heading should have read 'The Mapic "D2T" Soil Injector'. It is manufactured by Cooper, Pegler & Co. Ltd.

Swedish Deal

Western Germany has signed a deal agreeing to buy nine million bushels of wheat a year from Sweden for the next three years.

To Authors and Readers

The publishers of WORLD CROPS invite the submission of manuscripts of books to be considered for publication. All manuscripts will be promptly acknowledged and carefully considered by qualified experts. A synopsis with chapter headings should be sent in the first instance, addressed to the Book Production Manager.

The publishers are specialists in industrial, technical and scientific books and have a world-wide selling and distributing organisation.

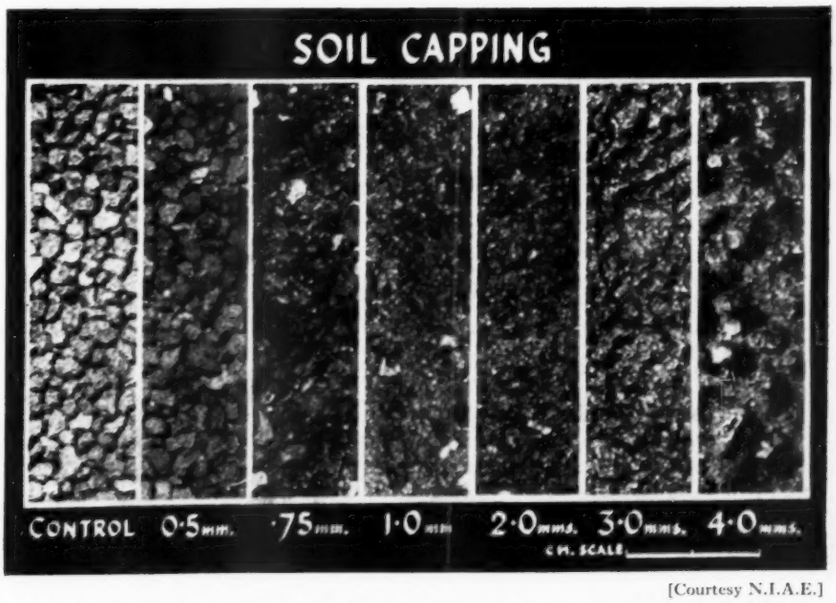
Soil Capping

A criticism often levelled against overhead irrigation systems is that they cause capping (or panning) to the soil. In certain circumstances this is true—as it is also true of natural rain.

When a drop of water hits the earth it expends its energy in breaking up the soil into finer particles. These fine particles then choke up the cracks in the soil, thus hindering the easy passage of air which is essential to plant growth and also the inward flow of further water falling on the soil. This process is known as capping or panning.

The size of the drops falling on the soil has a great bearing on the extent of the capping. Tests have shown that drops with a diameter of 0.5 mm. affect the porosity of the soil so little that capping is virtually non-existent, whereas drops of 4-mm. diameter break up the soil to such an extent that practically all the interstices are filled and, on drying, the top soil forms a crust, which prevents proper aeration of any part of the plant growing below.

Therefore, the problem with overhead irrigation is to produce equipment which will give a fine rain on the land. Farrow and Sons Ltd., English manufacturers, market an overhead irrigation system which largely sprays very fine droplets on to the land. Their rain guns have a turbine wheel which cuts into the jet of water as it emerges from the nozzle, breaking it up into a very fine rain. The larger models of the gun can also be fitted with an atomiser, which further breaks up the spray so that it falls as a fine mist.



[Courtesy N.I.A.E.]

This illustration shows clearly the effect on the soil of falling water drops. The greater the size of the drop of water the greater is the effect of panning

New Methods of Haymaking in Sweden

RICHARD HÅKANSSON

During the last three years the Swedish Institute of Agricultural Engineering at Ultuna, Uppsala, has carried out research on different methods of mechanised haymaking and mow-drying, which might be of interest also for British farmers. Since the Institute published the paper 'Planning the Harvest of Ley Crops with Special Reference to Mow-Drying of Hay' in the autumn of 1955, the new methods have been very much discussed in Sweden, where the hay harvest forms the peak of farm work, and where difficulties have been hard to overcome.*

THE practical results of the Swedish research work are summarised as follows:

1. The methods for ley-crop harvest that are recommended are silage-making, mow-drying, and rack-drying according to the 'paper-line' method, with mechanised loading.

2. Everywhere in Sweden the climate allows of mow-drying with cold air to be practised on the first cut from the leys.

3. Silage-making alone cannot be recommended.

4. The 'paper-line' rack-drying method with mechanical loading does not save as much labour as silage-making and mow-drying, though fewer investments are needed.

5. The ley-crop harvest should not be based on mow-drying exclusively, because of the risk of prolonging the harvest and lowering the hay quality in years of unfavourable weather conditions.

Leys—important crop

In Sweden ley crops, mainly clover and grass, occupy a greater acreage than any other crop (from 15% in southern Sweden to 75% in northern Sweden). The main purpose of growing ley crops is to obtain fodder of high quality for milk production. Therefore the requirements are high as to concentration of nutrients and digestible protein contents of the fodder. Where the acreage of ley crops is big compared to the labour available, the hay harvest forms the peak of the work period. Together with the scarcity of labour, the fact that the hay harvest must be done in a limited time often makes a very difficult labour problem in Sweden.

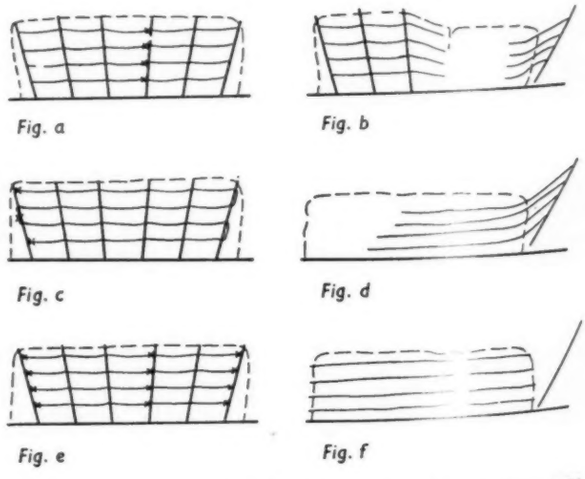
Thanks to the extensive investigations made by the Institute, there are answers to several of the most important questions. Generally, we cannot cut down the area of leys. The climate is good for ley crops. Cash crops can be increased in certain parts of the country, mainly in southern Sweden. Therefore Swedish agriculture will continue to be based largely on animal husbandry, for which the ley crops are very much needed.

What about extended silage-making? Silage-making has been practised in Sweden for a long time. But until now this method of preserving fodder has been used on a comparatively small scale; at a rough estimate, about 6% of the hay crop has been ensiled. From both the feeding and the labour points of view silage-making is a good complement to haymaking. In the report silage-making is discussed mainly as a complement to haymaking.

As to losses of nutrients in the fodder during the harvesting and drying processes, qualitative determinations have been made. These show, calculated in Scandinavian feeding units, an average lowering in value from harvest to feeding of 5% by good silage-making, 15% by mow-drying, 25% by good haymaking on racks, and about 30% by mechanised rack-drying. It is possible to obtain a higher degree of 'concentration' in the fodder by good silage-making and artificial drying than by the other haymaking methods.

Mechanised haymaking

Nowadays mechanisation has been promoted by good hay tedders, wind-



A diagrammatic representation of the 'paper-line' method of haymaking. The lines can be cut either at the centre or at the end of the racks. The poles are removed to facilitate loading

* 'Planning the Harvest of Ley Crops with Special Reference to Mow-Drying of Hay', Swedish Institute of Agricultural Engineering, Ultuna, Uppsala 7. The research work was carried out by the chief of the Institute, Mr. Nils Berglund, and his staff members, Mrs. Y. Anderson, G. Antansson, O. Moren and T. Anderson.

rowing devices and loaders. Thorough drying on the ground is as a rule not possible. Gathering the hay in cocks must be considered an outdated and uncertain method. Lacing the hay on poles (*kra ar*), which is practised in some areas of Sweden, is somewhat better than cocking and can be used for hay rich in grass, but it has not the same advantage for clover.

The best method of field drying is to put the hay on racks (*hässjor*) with horizontal perches or lines. A good aeration of the fodder by the wind is provided and there is comparatively good protection against rain. Pre-drying the fodder on the ground before putting it on the racks is favourable from the labour point of view. The loading from racks can be done by a pick-up baler or by a front-mounted tractor loader. In 1948 some investigations were done by the Institute on hay loading from racks by means of pick-up balers. The amount of hay loaded was 2.6 to 3.2 tons per hour. On most farms the front loader is most used. With this type of loader the output is higher.

Mechanisation is beginning to play a large part in the process of haymaking in Sweden. Picking-up is often accomplished with a front-mounted tractor loader

Mow-drying—the new method

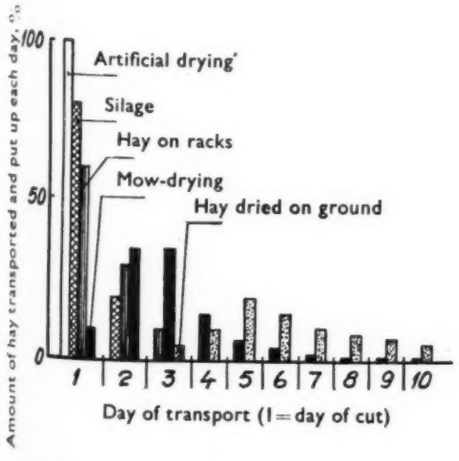
For artificial, high-temperature drying of hay a few technically satisfactory plants are available in Sweden, but even so this haymaking method is not common. It is mainly used when specialising in hay-meal making for sale and particularly when cheap fuel is available or when the drying plant can be used also for materials other than hay. Thus, artificial drying of the hay does not seem to solve the lay-crop-harvesting problems of the individual farmer.

Mow-drying of hay means that the hay is at first dried on the ground to such a state of dryness that the drying can be completed afterwards in a mow or barn with cold or slightly pre-heated air. Commonly the hay is stored on the drying outfit. Mow-drying implies sufficient pre-drying in the field.

From the labour aspect, silage-making and mow-drying are advantageous. The fodder is taken away from the field so early that the field can be ploughed and made ready for autumn-sown grain at the most convenient time. This can also be done as complementary work on wet days in the haymaking season.

Labour studies

Studies show that one-quarter of the labour can be saved by mechanised drying on racks and mechanised loading, and more than one-half by mow-drying and silage-making. From the labour point of view it is therefore better to mow-dry and ensile than to mechanise the drying on racks in the field. Mow-drying and silage-making are equal with regard to labour requirements. A combination of these two methods brings about a levelling of labour requirements during the ley-crop harvest. This combination is preferable to either silage-making or haymaking alone. Moreover, the two methods can be used and varied within wide limits. This applies above all to the first cut from the ley. Later, in summer and autumn, silage-making has to be used.



The diagram represents the days after cutting, in which the hay is either placed on racks or transported home for silage or drying, according to the method used

Costs

The investment costs increase in changing over from common rack-drying to mechanised rack-drying or mow-drying. This increase amounts to about 30% for mechanised rack-drying and loading, 120% for mow-drying with cold air, 180 to 250% for drying with pre-heated air, and 170 to 360% for silage-making. Haymaking thus requires less investment than silage-making when buildings for the hay are available, but the contrary is the case when new buildings are needed for the hay.

The total cost per hectare for the ley-crop harvest is lowered by 5 to 10% when changing from common rack-drying to mechanised rack-drying or mow-drying with cold air. The costs will rise 25 to 50% when changing to silage-making (with new-built silos) or to mow-drying with heated air.

(*Continued on page* 454)

New Fodder Crops in Danish Agriculture

SIGURD PEDERSEN

THE migration of labour from rural areas to the cities is the most characteristic feature of Danish agricultural development in recent years. This long-term trend, which increased after the war, will decisively affect the structure of agriculture in several respects. The consequences of this development can be seen in several spheres within contemporary Danish agriculture. In what follows, however, we shall only deal with a single problem among those which must be solved in the years to come. This is the production of fodder crops for cattle raising.

It is specially the root crops which, because of the high demands on labour, give rise to difficulties because production is too costly. Root crops are, however, of great importance to our cattle raising. Beets claim about 18% of the total agricultural area. But because of a high degree of utilisation, expressed in terms of fodder units (1 fodder unit = the fodder value of 1 kg. of barley), these crops represent a contribution of about one-third of the total yield of the crops. The labour requirement for root crops is, however, three to four times as great as on corn and seed fields and four to six times as great as on grassland. Moreover, the cultivation of root crops has the effect of greatly increasing the labour demand during the months when the beets must be thinned out and when they must be lifted, so that, with a large area of root crop cultivation, it is difficult to adapt the labour force to requirements.

Agriculture without cattle

There has, therefore, been a tendency in recent years, especially on the larger farms, to sell the cattle, abolish root-crop cultivation and work the farm exclusively with crops for direct sale. This tendency is reflected in the size of the cow population, the number of milking cows having dropped by about 50,000 during the last two years. This is not a disquieting drop, but it is a sure sign of the farmers' reaction to the development referred to above. This is, however, but one answer to the trend—we might call it the negative answer. For it must be remembered that, although some farmers will be able to earn more by resorting to agriculture without cattle, nobody will have an advantage if a great number of Danish farmers were to adopt this solution. To the individual farmer this policy will cease to be an economic proposition as soon as there is a considerable increase in crops available for direct sale, because the price will then drop. For the country as a whole, it will mean a decrease in revenue from export and, as the problem of foreign currency is Denmark's most important economic problem, such a development will be undesirable.

It is, therefore, necessary to seek another solution to the problem so that root-crop cultivation can be carried out with less labour or can be superseded by the cultivation of other fodder crops.

Cheaper root-crop

One way of solving the problem is to aim at a further mechanisation of root-crop cultivation. Much has been attempted in this sphere and results have been achieved which have, in particular, made harvesting an easier task. On the other hand, not much has been achieved in making the thinning-out process a more economic proposition. A certain reduction in labour requirements can be obtained by using ' single-germ ' seeds. Output surveys indicate that the saving during the thinning out is of the order of 25%, and ' single-germ ' seeds are therefore becoming more popular. But if this type of seed has not become even more widespread, this is due, firstly, to the fact that the germination conditions must be better than for normal beet seeds if a normal plant population is to be obtained and, secondly, it is desirable to use a special machine for sowing ' single-germ ' seeds.

It is thus possible to achieve results by trying to make root-crop cultivation cheaper. But there is little hope that mechanisation can be intensified to such an extent that the cost of labour can be decisively reduced. Moreover, even if the mechanisation problem could be largely solved, mechanisation will call for heavy capital investments beyond the financial capacity of the average farmer.

Cultivation of maize for storage

The next question is whether it is possible to find fodder crops less costly in labour which have a satisfactory yield, and which are sown and gathered at such times that the labour demand is evenly spread throughout the year.

A crop giving rise to some expectations in this respect is maize for silo storage. As with so many other innovations in Danish agriculture, the cultivation of maize was first taken up by some of the large farms and is now gradually being extended to smaller farms, although the cultivation has not yet assumed any significant extent.

Trials have been made with maize where the yield has been compared with that of beet. In 1955 (which was a good year for maize, but not so good for beet) the maize yield was two-thirds of root plus top in fodder-type sugar-beet. On the other hand, the labour requirements are considerably less exacting, being about one-half of the labour required for fodder-type sugar-beet. It is therefore the cultivation conditions on the individual farms which must decide to what extent there is an economic advantage in wholly or partly replacing beet by maize.

Rye and kale

Another possible solution of the problem lies in the cultivation of two crops in the same year for silo storage. A number of farmers have thus tried to sow, as a first crop, rye during the autumn, possibly with an admixture of vetches. This crop is harvested just before the rye ' slips '. It is reckoned that the rye crop can yield 3,000 to 4,000 fodder units.

(*Continued on page 451*)

Brazil as a Market for Agricultural Tractors

IN the course of the next five years Brazil is going to be one of the biggest available markets for agricultural tractors. The Brazilian Government are doing all in their power—in accordance with President Kubitschek's plan of work—to bring about an increase of the number of tractors in operation by no less than some 35,000 units to approximately 75,000 units by 1960—or an average of about 7,000 new tractors brought into service in Brazil every year from now until 1960.

This has considerably enhanced the traditionally keen foreign interest in Brazil as a market for agricultural machinery. But, although much has been said concerning the need to mechanise Brazilian agriculture, outside the State of Rio Grande do Sul, where the Rice Institute has done valuable work, not much of an objective nature has been published on this subject.

It is, therefore, fortunate that this has now been partly remedied in the State of São Paulo by a thorough investigation of tractor needs undertaken recently by the Brazilian firm, ' Distribuidora Vemag, S.A.'. Even though their survey describes conditions in only one division of the Union, it is still extremely important, because, as its authors point out, at the present time the State of São Paulo represents 50% of the country's potential tractor market.

First in South America

By way of introduction the authors of the survey review the past in so far as it bears on their problem. They remember that to as late a date as 1930, with the exception of the rice areas in the far south and sugar-growing areas in two or three centres, immigrants were cheaper than machinery. It was only after this time, and side by side with the growth of Brazilian industrialisation, that mechanisation in agriculture began to take shape. There was an enforced halt during the second world war and early postwar years, but from 1949 substantial quantities of tractors began to be imported, 4,357 units coming in in that year, 5,853 units in 1950 and 11,456 units in 1951. The total number of tractors in Brazil, including all wheeled and track-laying types up to 60 h.p., rose from 12,179 units in 1949 to 38,341 units in 1953, putting Brazil more or less on a level with Argentina. In 1954, however, the number had increased to 40,645 units, placing Brazil first in South America with regard to the number of tractors in operation.

U.S. manufacturers have benefited most by this expansion. Throughout the years an average of about 40% of American exports in agricultural machinery have gone to Latin America. In 1951 the three countries of Mexico, Brazil and Argentina alone accounted for 60% of Latin American tractor purchases from the U.S.A., the Brazilian total being worth 31.3 million dollars. Nevertheless, say the authors of the study reviewed in this article, ' notwithstanding this development, Brazil is still in the infancy of agricultural mechanisation in view of her power of absorption, the vast number of farms needing supplies and the ever-increasing shortage of hands '.

The investigations took for sample 30 representative municipalities in the State of São Paulo, wherein 450 questionnaires were distributed to farmers (only four were not returned), 120 to farm-equipment dealers and 30 to regional agronomists in the service of the State Secretariat of Agriculture. The municipalities were selected not only for geográphical considerations, but also with a view to including the principal producers of coffee, cotton, sugar-cane, rice and maize, as well as those centres containing farm-equipment dealers. The collection of data was entrusted to six field-workers

The many different functions that a tractor can perform—including land clearing—are all put to good use on Brazilian farms. Tractor driving and maintenance instruction is an essential part of the teaching programme of more than 1,000 training centres throughout Brazil

acting in pairs, each pair being under the guidance of an inspector.

Special tractor requirements

The field-workers returned with evidence that nearly three-quarters of the coffee planters who employ tractors prefer the wheeled type of 20–25 drawbar h.p. However, this means exclusive coffee planters; planters who engage mainly in coffee, but do diversify, nevertheless, are seen to have some leaning towards machines of somewhat more power on the drawbar; but 90% of the tractors remain at 30 h.p. or less.

In cotton areas it was found that about half the tractors in use were within the 20–25-h.p. group, and for maize the same group predominated, although to a smaller extent and with a certain emphasis on more powerful types. It should be mentioned that the power factor is not absolutely related to the crop itself, being influenced also by other considerations created by the crop or connected with it. Rice is another instance in which the 20–25-h.p. group enjoys a certain preference, but the predominance is for heavier machines with a tendency to tracklayers in irrigated zones. With sugar-cane the picture is different: here it was found that half the tractors in use were of more than 40 drawbar h.p., most of them being tracklayers. But in the less powerful types wheeled tractors predominated.

Summing up, the investigators say that if one excludes from the general data all cases demanding tractors for special purposes, such as the preparation of soil as in sugar-cane and irrigated rice, one discovers an overwhelming preference for wheeled tractors of 20–25 drawbar h.p., followed by the group composed of 25–30 h.p. This coincides almost exactly with an investigation undertaken in 1952 by the Getulio Vargas Foundation and confirms previous nation-wide Government surveys, in which the conclusion has been put forward that the ideal tractor for Brazil is a wheeled one of about 20 drawbar h.p.

Huge unfulfilled demand

It is noteworthy amongst the leading crops in the State of São Paulo that well over 50% of farmers who concentrate on maize have mechanised, more than half of those dedicated to rice have done so, and over 40% of the coffee planters have followed the same road. Sugar-cane is 27% mechanised and cotton 20%.

Looking at the mechanised condition of the whole State, it was found that only 4% of properties up to 180 acres have machinery, and only 20% of properties up to 600 acres are in that condition. About 40% of properties between 600 and 1,800 acres are mechanised, and no less than 65% of properties of more than 1,800 acres possess mechanical equipment. In other words, the smaller the properties, the less the amount of agricultural machinery available.

But one of the most interesting findings of the investigation was obtained when small farmers who do not possess a tractor were consulted about future intentions. No less than 40% expressed a definite desire to acquire one, and of the remainder about half were undecided, [illegible] looked with

favour on the idea. This desire to mechanise on the part of the small farmer is confirmed by an investigation carried out in 1952 by a group of Government agronomists in relation to the whole of Brazil. It is easy to see what this means when it is considered that no less than three-quarters of the 30 million acres of rural properties in Brazil are of between 2 and 100 ha. (5 to 247 acres).

In accordance with a recent calculation by the Ministry of Agriculture, if all Brazilian farmers who have a definite desire to acquire a tractor were given facilities for so doing, Brazil's present tractor needs would rise to some 750,000 units; even more important, in practically all cases in which this definite desire is expressed the tractor could be made to pay for itself in a relatively short time. It is interesting to note that if Brazil had 750,000 tractors, with a cultivated area of some 50 million acres, this would work out as an average of one tractor for each 66 acres—or less than half the present level of farm mechanisation in Britain (some 350,000 tractors for a cultivated area of some 11.3 million acres—or one tractor for each 32 acres). To be on the same level with Britain in agricultural mechanisation Brazil would have to have no fewer than 1,500,000 tractors, and this to work only the acreage under cultivation at present, which is a mere 2% of good arable land in Brazil.

Seen against this huge unfulfilled demand, Brazil's 75,000 tractors by 1960—if all goes according to plan—will represent no more than 10% of present demand, to say nothing of potential requirements. It is, therefore, easy to see how futile and uneconomical it would be for Brazil to try in the long run to import all the tractors she needs. In such a vast potential market local manufacture seems to be the only possible answer, even though, for the time being, heavy imports will have to be effected. It is no wonder that so many foreign manufacturers—amongst which are Fiat, Ferguson, International Harvester etc. —are going ahead with plans to make their own tractors in Brazil.

This information was first published in the *Brazilian Bulletin* and is reprinted with permission of the Brazilian Government Trade Bureau, London.

Leonard Hill to Visit Australia and the U.S.A.

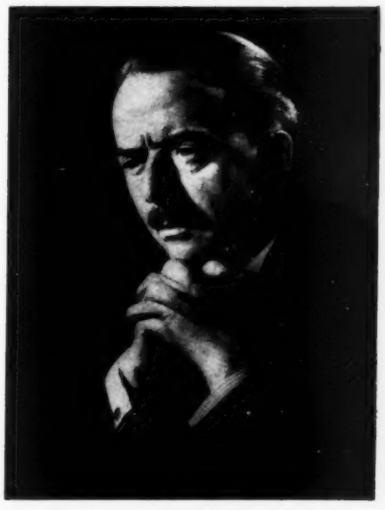
Mr. W. Leonard Hill, Founder and Chairman of the Leonard Hill Technical Group, plans a round-the-world trip to consult with the Group's agents, advertisers, contributors and other associates in Australia and the U.S.A. He expects to leave England in the third week of November for the voyage to Australia, where he will visit his friend of many years' standing, Sir Norman Nock, a prominent industrialist and former Lord Mayor of Sydney.

To the U.S.A.

Mr. Hill will then sail across the Pacific to San Francisco and, after spending some time there and in Los Angeles, will travel to New York, from where he will leave for England in April.

Mr. Hill last visited the U.S.A. towards the end of 1955. He also toured the Caribbean islands and on his return to London he summarised the impressions of his tour in a talk which was delivered before a large audience at the Royal Society of Arts.

Mr. Hill will be accompanied by his daughter, Miss Lynette Hill, now a member of the firm, who will act as his secretary. Mr. Hill's addresses during his tour are as follows:



Mr. W. Leonard Hill, Chairman of the Leonard Hill Publishing Group

January: c/o Nock and Kirby Ltd., 417-421 George Street, Sydney, Australia.

February/March: c/o Hixson and Jorgensen Inc., 3257 Wilshire Boulevard, Los Angeles 5, U.S.A.

March/April: 92 Lorraine Avenue, Upper Montclair, New Jersey, U.S.A.

Technical News

Building Materials for November will include an article on ' Treatment and Painting of Timber for External Use '.

Floors also includes an article on ' Wood—Its Properties as a Flooring Material for Various Purposes '.

The contents of *Paint Manufacture* for November includes ' Polyesters for Surface Coatings ', ' The Hiding Power of White Pigments ', ' An Analysis of Colour Preferences ' and ' Testing Paints by Outdoor Exposure—II '.

Chemical and Process Engineering for November contains an article on ' Heat Transfer Media—I ' by P. M. Krishna and D. Venkuteswarlu.

The November issue of *Petroleum* will include articles on ' Fuel Investigations at Cranfield ', ' Isobutane Production ', ' Water-cooling Problems ' and ' Infra-red-absorption Analysis in the Petroleum Industry '.

Articles included in the November issue of *Automation Progress* are ' Automatic Control in the Process Industries—I ' by A. Pollard and ' Cybernetics: the Science of Control Systems ' by P. A. George.

Danish Agriculture

(*Continued from page* 448)

As soon as the rye is gathered, kale is sown as a second crop, which has a yield at least as great as that of the rye. Together these two crops should thus give about the same yield as a beet field. Moreover, the work can be mechanised to a much greater extent and the labour demand can be spread much more evenly throughout the year than with root-crop cultivation.

This type of cultivation is still new and trial results are not yet available. But there can hardly be any doubt that both maize and these double crops will become more widespread in the years to come.

The transition from root-crop cultivation to other fodder crops will, however, call for considerable investments, in silos as well as harvesting, especially in cutters. But the necessary capital must be found because, as the migration of labour continues, the solution of this problem is becoming more and more important.

NEW PUBLICATIONS

The Land Called Me

By Sir E. John Russell (an autobiography). Pp. 286, illustrated. London: G. Allen and Unwin. 1956. 25*s*.

This has been one of the most interesting autobiographies it has been my privilege to read and review. It is not an easy task to review a book of this nature for the preparation of an autobiography is more than a collection of data arranged in a logical sequence or an *exposé*, but it is rather an *apologia pro vita sua*, and this, too, can take an infinite number of forms. Sir John has a fascinating story to tell and he tells it in a manner moving in its simplicity, unequivocal in its intention and forthrightly, as is his wont.

World agricultural experts hold the author in the highest esteem and without doubt their respect for this great man of British, nay, of world, agriculture will be magnified when they have read this the account of his life. Born in 1872, he is the eldest son of a Dissenting Minister with a large family and small stipend; he had to leave school at the age of fourteen. Sir John deals at length with his early, formative years and draws a vivid picture of social life in the later Victorian era.

The account of his work in London of the '80s contains many diverting anecdotes. His ultimate ambition was to study chemistry and we are led with him through struggle and adversity until he was able to enter Carmarthen College, then University College, Aberystwyth, and finally to Owen's College, Manchester. It was there that his *penchant* for social work and his schemes for reducing the serious problem of poverty in Manchester led him to agriculture. On accepting a post at Wye College it was not long before he realised that agriculture needed all the assistance that science and scientists could give it.

Many years of work and study led him to Rothamsted Experimental Station; he was appointed head of that research organisation five years later, in 1912, and continued to direct its work for more than 30 years. Rothamsted flourished and became the magnificent institution it is today. His work led him to many countries. The vivid descriptions of the life and work of peasant farmers, scientists and statesmen have all the characteristics of a searching eye and a discerning mind.

The problems encountered and overcome by him have their place in this book and add to its intrinsic value.

Great honours have been bestowed on this man, but he remains, as his autobiography shows, essentially and simply, a man of the land.

No better words than his can sum up a philosophy many of us could do well to emulate: 'Fortune has indeed smiled upon me. After some search I had found my work and had much joy in doing it. I have made no fortune, but my life has been cast in very pleasant places. I have been particularly happy in my home and my friends, and in the health and strength which have enabled me to do something which, though far short of what I wished, has, I hope, proved of service to others travelling the same road. The land had called me and I had done my best to answer the call'.

H. TRAVERS-BROOKE

Features of Evolution in the Flowering Plants

By Ronald Good, M.A., SC.D. Pp. 405, illustrated. London: Longmans, Green and Co. Ltd. 1956. 30*s*.

Evolution, the process of continuing change by which plants and animals have descended from fewer and earlier kinds, is demonstrated by the flowering plants, in Prof. Good's words, on the grand scale and in active expression, and he commends their study as a neglected field for the student of evolutionary process. He is here not concerned with the changes induced by man, which have developed the plants of the garden and crops of the field, but with the older and more fundamental processes which have produced the wealth of plants clothing the earth in all their diversity, the palm trees and the primroses, the daisies and the duckweeds.

The main part of the book is a review of the flowering plants and a discussion of their form and structure, as throwing light on the course of their evolution. In discussing the two great series of Monocotyledons and Dicotyledons, the author points out the nature of the differences between them and the narrowness of the separating gap. Though shunning the orthodox nomenclature of the systematist, he divides these great groups into lesser groups corresponding roughly with the families, and he expresses their size, relationship and degree of separation in a three-dimensional form resembling an astronomical model. He uses plants of certain groups, particularly of the asclepiads and composites, to illustrate features of special value in this study. He refers particularly to the repetition of similar characters to be seen in widely separated families, and to the apparently gratuitous or motiveless changes which have survived in plants while conferring no evident benefit upon them. In his final chapter he summarises the substance of earlier chapters and uses this material to formulate his conclusions on the evolutionary process.

This is a stimulating book, posing more questions than it answers, and it deserves to be read not only by the botanist, but by all interested in the origin and development of living things. It is ably written and illustrated by an admirable series of figures appropriate to the text. The reader is assisted by the timely pauses the author makes in his argument in order to look back over the ground covered and see where he has reached. While the reader may not be prepared to accompany him all the way, he can hardly fail to be stirred by the author's argument into searching his own mind and considering what he himself believes about these things.

T. A. RUSSELL

The Wheat Industry in Australia

By A. R. Callaghan and A. J. Millington. Pp. 486, illustrated. London: Angus and Robertson. 1956. 63*s*.

One of the most surprising things that come to mind with the publication of this book is: Why has the Australian wheat industry been neglected in this field of agricultural literature for so long? One cannot believe that there were not men in the past who could have presented a wide but detailed study of the wheat-growing scene in Australia in a form assimilable by both the man on the land and the researcher, for ready reading both at home and in other wheat-growing countries of the world. However, with this book

Callaghan and Millington have repaired a remarkable omission. In passing it is noteworthy to remark that 'The Wheat Industry in Australia' was published with the aid of a grant from the Rural Credits Development Fund of the Commonwealth Bank of Australia.

When compared with the Old World, Australia's development in the social and industrial scene has been rapid because oftentimes she has been able to profit by the work undertaken in earlier years by other countries, but it is natural that many problems have arisen that could only be solved within her own boundaries and largely by trial and error and research. Beginning with the earliest times, the authors have traced the development of wheat-growing, one of Australia's greatest primary industries. But it is not only an historical outline; it also deals with all the problems that face the wheat farmer—the cause and prevention of soil erosion, the fight against diseases, the storage and transport of wheat over great distances, the mechanisation of sowing and harvesting, and the economic, social and political ramifications of the industry. Then, too, soils, fertilisers, methods, varieties, breeding, botany, farm size, f.a.q. versus grading, international wheat agreements, and many other important subjects have been dealt with in a logical and far-seeing manner.

In the preface the authors point out: 'This is the first comprehensive book on the Australian wheat industry. It is over 40 years since the late Dr. A. E. V. Richardson published his booklet, *Wheat and Its Cultivation*, which dealt mainly with cultural aspects of the crop. Since then the wheat farmers of Australia have consolidated their experience, and many technical advances have been made . . .

'Today there is greater diversity of production on Australian farms. The acreage devoted to wheat has contracted, while yields per acre have increased. Exploitation of the soil's resources has given way to conservation, and a new tradition is in the making. This book comes at a time when a general stocktaking should serve as a foundation for future research and the application of new methods to the greatly diversified system of farming now being adopted.'

This book is fully illustrated with nearly 300 photographs and many maps, tables and diagrams. It is an up-to-date study that will be useful to the practising agriculturist, the student and the research worker.

E.L.B.

Sugar Cane Around the World

By Arthur H. Rosenfeld. Pp. 562. University of Chicago Press. 1956. $6.50.

Dr. Rosenfeld's experience extended from 1910, when he became Director of the Tucuman Sugar Experimental Station in Argentina, until his death, in 1942, after 10 years as sugar-cane technologist to the Egyptian Government. In the interim he worked in Louisiana and Puerto Rico and this wide scope of experience, coupled with a systematic and inquiring mind, fitted Dr. Rosenfeld particularly well for the task of considering sugar-cane and its cultivation on a world-wide basis.

The book covers the practices and opinions existing in many parts of the world, with particular reference to the 1930–40 period, and contains much information not readily available elsewhere. The text needs to be read critically and, because of the delay in publication, due allowance must be made for recent advances in technology. Nevertheless, there is much of interest to the serious student of the development of sugar-cane agriculture, and the reader can gain a very useful impression of the varying soil and climatic conditions under which sugar-cane is grown throughout the world. This is, perhaps, the most valuable aspect of the work and much of the information is of present-day application and can form a background for those interested in acquiring a comprehensive knowledge of sugar-cane agriculture.

The first three chapters deal briefly with the history of sugar-cane, its botanical and physiological characteristics and composition. The chapter on climate deals in a general manner with conditions in various cane-growing areas and with the effects of freezing.

Soils are dealt with on a basis of chemical and mechanical analysis, with specific descriptions of important soil areas. The chapter on fertilisers, besides giving information of the use of various inorganic fertilisers, discusses the use of such materials as molasses and factory wastes.

The remaining third of the book deals with a variety of subjects under the heading 'Preparation, Drainage and Irrigation' and, because of the geographic range of the areas considered, this section is of particular interest.

In spite of the delay in publication, there is little doubt that technologists, as well as more general readers, will find much of interest in its 500 pages, and the wide range of material considered will, undoubtedly, meet with general approval.

H. A. THOMPSON

Jamaican Department of Agriculture

Annual Report for the year ended 31 December, 1954, and Bulletin No. 54, which is the sixth of the 'Investigations' series; the bulletin represents a progress report on all the research projects undertaken by the Department during the calendar year 1954. It is noted that the depredations of the fiddler beetle have caused great concern to the citrus industry and a series of insecticide trials to control this pest have yielded interesting results. A long series of banana fertiliser and spacing trials yielding definite results have been completed. Further trials have been laid down, using new levels and frequencies of application of fertilisers and trying different agricultural practices. Spraying trials for the control of leaf spot on bananas are beginning to show positive results.

Other interesting work on rice variety, pineapples and coconuts is published in this bulletin. The Annual Report is obtainable from the Jamaican Department of Agriculture, Kingston, Jamaica, price 4*s.* 0*d.*, and the bulletin is obtainable at 3*s.* 6*d.*

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Rothamsted Experimental Station

We have received a copy of the report of the Rothamsted Experimental Station for 1955. This report, as usual, provides a comprehensive account of the work and results obtained there during the year. Work

of considerable interest has been carried on in the Plant Pathology Department, where virus diseases are being studied in a wide range of crops, including potatoes, sugar-beet, barley and various legumes and crucifers. Potato paracrinkle virus, which is universal in the variety King Edward, seems to be an aberrant strain of potato virus S, which occurs in many other potato varieties. By excising apical meristems from King Edward plants and culturing them on agar, a clone of this variety has been established that seems to be free from paracrinkle virus. Potato virus C, although a strain of the common aphis-transmitted potato virus Y, is not transmitted by aphides when obtained directly from infected potato plants. An isolate that has been maintained for years in tobacco plants under glass has, however, become transmissible by aphides, but when transmitted to potato and returned to tobacco this isolate usually lost its ability to be transmitted by aphides.

In the Insecticides Department recent work has led to a much greater understanding of the reasons why a change in particle size of a contact insecticide produces a change in its toxicity. The effects of temperature on this change in toxicity have been studied in detail, and a theory has been put forward which may sometimes enable the effect of temperature on the relative toxicity of different-sized particles to be predicted. Price 8*s.* 6*d.*

*

University of Nottingham

The University of Nottingham has published the first of what they hope to be an annual report of its School of Agriculture. This first report for the year 1955 deals *inter alia* with such topics as soil studies, factors affecting plant growth and farm management studies.

*

Perkins Handbook

A new publication—the ' P Series Vehicle Diesel Engines '—has been produced by F. Perkins Ltd. Similar booklets on the P series agricultural and industrial diesel engines have also been prepared. They are available for operators, mechanics, students attending the company's instruction school and members of the Perkins Drivers' and Agricultural Drivers' Clubs.

The new series has been compiled to provide a compact set of maintenance instructions for users of all types of Perkins P series engines. They are divided into two sections. One, for drivers, is concerned mainly with starting, running instructions, minor maintenance and precautionary measures against frost. It includes a list of approved lubricating oils and a number of essential do's and don'ts. The other section, for mechanics, is more technical and includes settings, fault diagnosis, fault finding, fuel injection equipment, cylinder head maintenance and timing.

*

Long Ashton Report

The Annual Report of the Agricultural and Horticultural Research Station, Long Ashton, Bristol, for 1955, produced in the same format as last year, contains many interesting research papers. Of particular interest were the results published by the Plant Pathology Section, dealing with spray-application problems; 10 pages of various aspects of this subject are included.

*

EPPO Publications

The European and Mediterranean Plant Protection Organisation has recently published three reports, dealing with *Aspidiotus perniciosus* Comst (San José scale), *Synchytrium endobioticum* (Schilb.) Perc. (potato wart disease) and *Leptinotarsa decemlineata* Say (Colorado beetle) activities in Europe, 1955.

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FAO Publications

Food and Agricultural Legislation, 1955, *Vol.* 4, *No.* 4. The pamphlets included in this group concern Legislation and Agricultural Developments in Germany, Plant Protection in Guatemala, Land Tenure and Land Reform in the Philippines and Spain, and Trade in Fertilisers in Argentina.

Co-operative Marketing for Agricultural Producers. This guide book looks very briefly at the machinery of any marketing transaction, co-operative or private, and then discusses some of the distinctive characteristics of co-operative marketing. There follows a clear description of what marketing co-operatives actually do from day to day, of the way in which they are financed, of their legal form and the rights and duties of members. This is followed by some notes on the accounts and records which must be kept by the simpler primary societies. Price 5*s.* 0*d.* U.S. $1.00.

We have received a copy of *Constitution, Rules and Regulations of the Food and Agriculture Organisation of the United Nations.*

*

I.C.I. Game Services

I.C.I. has recently published the annual report of work done by gamekeepers and scientists on the I.C.I. Experiment Estate, Fordingbridge, Hampshire, England.

*

Farm Buildings

Under the title ' Farm Buildings—Conversions and Improvements ', this book has been prepared by W. G. Benoy, A.R.I.B.A., and published by Crosby Lockwood and Son Ltd., London. It is designed to show farmers, land agents and others concerned just how farms can be improved, and thus rendered more profitable, by the conversion of existing buildings. This contention is demonstrated by the description and illustration of a number of actual schemes. Price £1 8*s.* 0*d.*

New Methods of Haymaking in Sweden

(*continued from page* 447)

Thus haymaking is cheaper when buildings for hay are left out of account. As to silage-making in trench silos, experiences are too limited to allow conclusions to be drawn with respect to costs.

Survey on climate

In order to investigate statistically the possibilities of sufficient pre-drying before mow-drying, a special survey on the summer climate in Sweden has been undertaken. Records for the months of June to September, for a period of 20 years, indicating the amount and distribution of precipitation, temperature and humidity of air, and the degree of cloudiness and wind velocity, were studied. In the same way a survey was made on the frequency of rainy days in consecutive three-week periods during the summer months from 1901 to 1950.

MACHINERY AND EQUIPMENT

Flying Jeep

A new aircraft, the EP9, has been developed by Edgar Percival Aircraft Ltd. and is now going into full production. Planned production for 1957 is 150 aircraft.

The EP9—a flying jeep—carries a pilot and five passengers or a ton of fertiliser.

It was designed for crop spraying, top-dressing and other agricultural duties, but can fulfil a number of alternative civil and military roles.

Description

The EP9 is of simple design, robust and of light weight.

The power unit is a Lycoming GO-480-B horizontally opposed, six-cylinder, wet-sump engine of 270 h.p., driving a Hartzell HC-82X20-1B constant-speed airscrew 7 ft. 6 in. in diameter. The four engine-cowling panels are fitted with quick-release fasteners.

The fuselage frame is of welded steel tubing; this material overcomes the corrosive effect of agricultural fertilisers and sprays.

A heavy tube frame immediately behind the pilots' seats takes the main wing-spar and undercarriage loads.

The cockpit accommodates two pilots with dual control. The pilots' seats are stressed to withstand 25*g* and are placed on a level above the engine and the load for maximum safety.

The undercarriage is of Percival design. It is designed for a vertical velocity of 9 ft./sec. and, because of its long travel, is claimed to have better energy/absorption characteristics than many deck-landing undercarriages designed to 11 ft./sec. Floats can also be fitted for marine operation.

Reader Service

For further information on any item of machinery or equipment reviewed in this section please write to:

Reader Service,
WORLD CROPS,
Stratford House,
Eden Street, London N.W.1,
England

Agricultural Tyre

The 9.00-16 R.B.P. land tyre is specially constructed for agricultural use to suit conditions where a normal land tyre might be excessively abused, badly maintained and thus not be quite up to the strength required for heavy work in rough country. This does not mean that R.B.P. land tyres can be run without maintenance.

The tyre is of 10-ply construction and is thus very much stronger for

The tread design of the 9.00-16 R.B.P. land tyre is left plain in order to cut down the amount of pick-up

dinary agricultural usage than the normal eight-ply smaller-section tyre in common use. It is a processed tyre, based on a very strong casing with a well-defined ribbed tread pattern, which has the effect of giving the maximum ease of rolling motion on soft surfaces, and is sharply defined and deep enough to prevent side-slipping with agricultural machines and tractors. The 9-in. section tends to support the load with the minimum sinkage.

The tread design is left plain, without interrupting buttresses, so that it will pick up the minimum amount of soil etc. when operating in muddy conditions, and will tend to clean itself, so that no excesses are carried on to the highway.

Multilode

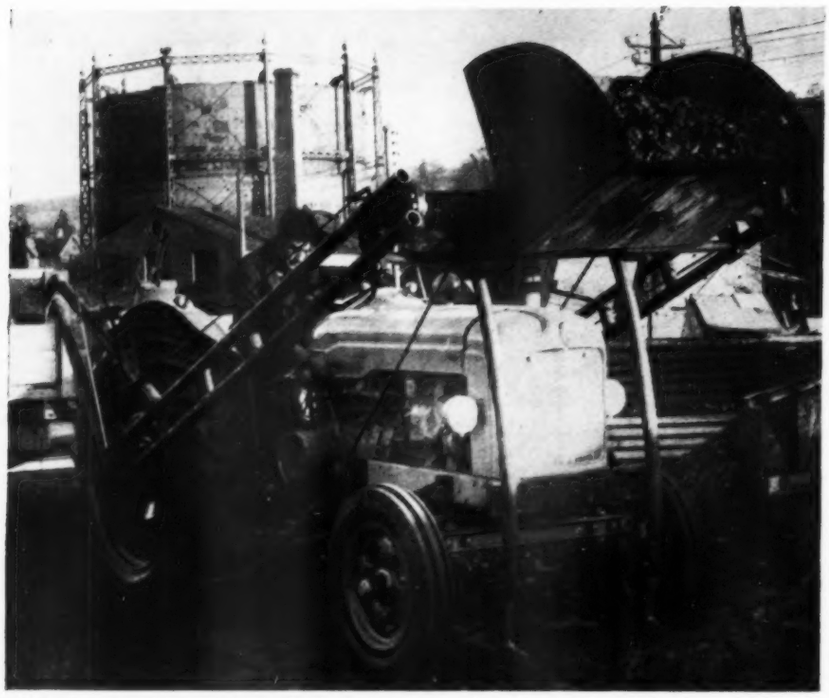
This entirely new type of tractor loader from Twose does not use hydraulics or auxiliary engine. The principle employed is simpler, more direct and consequently much quicker in operation.

The loader consists of a framework attached to shafts, which are in turn bolted to rear wheel hubs of the tractor on either side. On to the front part of the frame are bolted the tines or bucket, whichever is being used.

Loading

The method of loading is to lock the framework to the rear wheels and reverse the tractor until the tines or bucket are immediately above the trailer. The unit only moves about 4 ft. to complete this operation. Pro-

The EP9. The fuselage frame of this aircraft is of welded steel tubing. The manufacturers claim that this overcomes the corrosive effect of fertilisers and sprays



With some tractors, such as the Ferguson, an epicyclic or other reduction gear must be fitted for the ' Multilode '. This is not necessary with tractors already fitted with an extra low gear such as the Fordson Major or David Brown

vision is made on the framework (by means of two triangular legs which come into contact with the ground) to stop the framework when it reaches the correct tipping position above the trailer. When a forward gear is engaged on the tractor the framework returns to its original position.

Provision is also made so that the loader can be held in a number of different raised positions for transport and other purposes. The bucket or tines can also be tripped, both in the forward and rear positions.

In order not to overload the transmission of the tractor, counter-balance springs are fitted so that the tractor is only lifting the weight of the bucket or tines plus the material being loaded.

Economy of movement

When using the ' Multilode ' a minimum of movement and manoeuvring is involved. Unlike operation with other tractor loaders, the trailer does not need to be unhitched from the tractor during loading.

The unit does not monopolise the tractor, as the whole loader can be attached or detached in less than 15 min.

It can be used as a root-crop loader, hay, straw or bale loader, buck rake, green-crop loader, sheaf loader etc.

Spray Gun

Bullows announce an entirely new gun of revolutionary design. It has been developed over the last two years in conjunction with female sprayers in a variety of trades and has literally been built to the operator's specification.

Its main feature is that it gives good handling and balance, is extremely light in weight and enormously reduces operator fatigue as compared with the conventional spray gun.

The trigger design is a major advance. The operator's index finger lies naturally along the full length of the trigger, giving precise and accurate control by very light pressure. The spray width can be quickly and accurately adjusted by a knurled control screw on the side of the gun, and a wide range of nozzles is available for most applications.

The gun can be pressure fed from a pressure container or gravity bucket and will operate with a siphon cup.

The body of the new Bullows spray gun is a duralumin forging with all wearing threads in brass inserts

Earthmoving Equipment for Track-Marshall

The Track-Marshall 48-b.h.p. diesel crawler tractor can now be supplied with either a hydraulic angledozer or hydraulic bulldozer. Both the equipments have been designed specifically for the Track-Marshall by W. E. Bray.

The design of the hydraulic system is common to both the equipments and consists of a live pump, driven from the front of the crankshaft, a reservoir tank containing the control valve assembly, which is mounted beside the driver, and two double-acting hydraulic rams which lift the blade through quadrant arms.

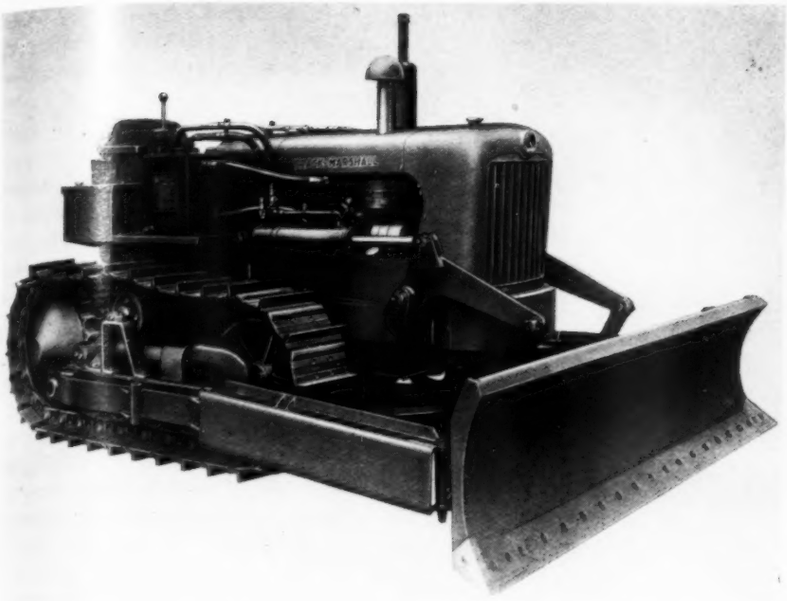
The angledozer blade is mounted on a separate A-frame which allows the blade to be angled to both the left and the right. The blade can also be cambered in both directions. The bulldozer blade and frame are an integral unit. Renewable and reversible cutting edges are fitted to both the equipments and replaceable corner shoes are fitted to the angledozer.

Specification	*Angledozer*	*Bulldozer*
	ft. in.	*ft. in.*
Blade length ..	9 3	7 1
Blade height ..	2 0½	2 4½
Blade lift above ground level ..	2 9	2 9
Blade dig below ground level ..	1 1½	1 0½

Garden Device

The ' Swoe ' is a hollow-forged, rust-resisting cutting blade which is ground on three edges to enable the gardener to work with a rhythmic scythe-like action forwards and backwards with the blade flat in the top inch layer of the soil.

The design and action of the ' Swoe ' results in the formation of a fine tilth without damaging soil structure and plant roots.



The Track-Marshall diesel crawler tractor, powered by a Perkins 48-b.h.p. diesel engine and equipped with the Bray hydraulic angledozer

The ' Swoe ' is most effective in dealing with weeds and the gardener is able to work close up to the plant without damage. If used regularly throughout the growing season, most weeds can be controlled at the germination stage.

The handle of the ' Swoe ' has been designed to give maximum comfort in use with a natural ease of body movement.

Shatterproof Greenhouses

Transparent thermoplastic sheeting —which admits more growth-stimulating ultra-violet rays, is shatterproof and unaffected by weather changes— replaces glass in a new range of portable greenhouses now available. There are also considerable savings in cost and weight.

These greenhouses (made by Andrew Smith Harkness Ltd.) are available in three sizes, with one specially for the average garden which can be carried easily by two adults. They are fitted firmly in position by sturdy steel spikes, dispensing with the need for brick foundations.

It is claimed that this thermoplastic sheeting is virtually indestructible. It is proof against garden pests, fungus and rot; is non-inflammable and impervious to all acids. Risk of damage by supersonic bangs is considerably lessened, since the sheeting cannot be broken or shattered on impact.

The FR two-furrow mounted reversible plough at work

Construction

Construction in sections gives ease of erection. Each section simply bolts up with the next and a special device takes up slack on the sheeting.

Changing the site of the greenhouse presents no problems and this easy portability eliminates replanting or hardening-off of plants.

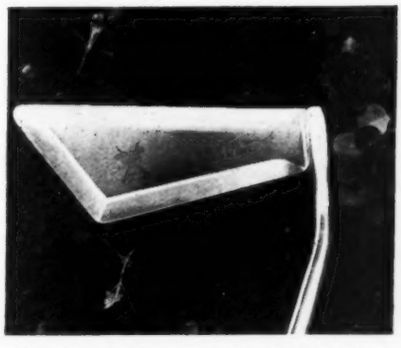
The structure is of interlocking sections of rustproof painted tubular steel. When these are bolted together the framework is absolutely rigid and will not buckle or distort. The basic tubular sections can be added to and any length of greenhouse made. Ventilation is amply provided in all three models. In the commercial model two tubular framed ventilators are fitted in the roof.

Mounted Reversible Ploughs

Ford Motor Co. Ltd. and Ransomes, Sims and Jefferies Ltd. have announced two new types of mounted reversible ploughs. The ploughs are the FR TS68 two-furrow and the FR TS74 one-furrow. The TS68 has already been tested and sold extensively abroad and has proved satisfactory in every way.

Both these ploughs are a distinct improvement in design. Unlike previous reversibles, they are self-contained units, since the reversing mechanism is incorporated in the frame of the plough itself. They are now coupled up to the three-point linkage only and no extra fitting of the reversing lever to the tractor is required.

The TS68 is primarily designed for use with the Fordson Major tractor, but can also be used with other tractors fitted with the category II linkage. It weighs 1,020 lb., being well within the lifting capacity of the tractor, and the ' turn over ' reversing action operates in conjunction with the locking device,



The ' Swoe's ' rust-resisting blade, hollow-forged, is ground on three edges and is used evenly, forwards and backwards, with the blade flat

which ensures that each furrow is of precisely the same depth as the last. Disk coulters and skim coulters are provided and it is fitted as standard with steel wheels, but pneumatic-tyred wheels are offered as an alternative. The TS68 ploughs to a depth of 10 in. and alternative fixed furrow widths of 10, 12 or 14 in. are available.

This Model 705 New Holland crop drier has a 36-in. fan powered by a 5-h.p. electric motor and includes an oil-fired heating unit and thermostatic controls

General-purpose, semi-digging or digging bodies can be fitted.

For use with the same type of tractor as the TS68, the TS74 weighs 970 lb., and the reversing and locking mechanisms are similar to those of the TS68. Disk and skim coulters are provided as standard, as are the steel wheels with pneumatic-tyred wheels as alternatives. The U.D. deep-digging bodies which are fitted will plough up to a depth of 14 in. and 16 in. wide.

Land Leveller

We have been informed by Catchpole Engineering Co. Ltd. that they are manufacturing the Eversman land leveller under licence in Britain. This machine was first illustrated in the article ' Precision Surface Drainage for Sugar-cane Land ' by Irwin L. Savelson (WORLD CROPS, 1956, **8**, 309). The British manufacturers have already received a number of orders for this implement.

Flame-cleaning Process

One of the important problems facing the agricultural industry is the maintenance of farming tools and machinery. Equipment which is subject to all weather conditions easily becomes corroded and the wide use of chemicals in manures and fertilisers can have an adverse effect on some farming implements.

Corrosive deposits can be chipped away by hand or with a wire brush, but this method is a lengthy one and does not ensure that the surface is absolutely clean and free from moisture, an important factor if paint is to be applied.

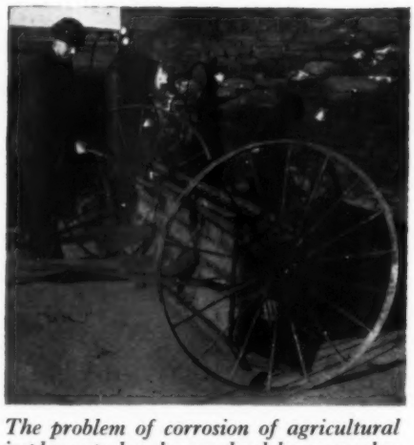
Farmers in Scotland have found that by using British Oxygen's oxy-acetylene flame-cleaning equipment they can quickly and easily remove corrosive deposits, which results in a clean surface for further painting and also ensure a longer paint life.

Flame-cleaning can be used on all types of farming equipment, ranging from manure-coated shovels, forks and wheelbarrows to ploughs and tractors. It can also be used satisfactorily on farm outbuildings and general field structures, such as steel fencing, and drinking and feeding troughs.

Portable Crop Dryer

A new drier that makes multi-purpose crop drying practical for the average farm was announced recently by the New Holland Machine Co.

The new drier is portable, economic to operate, adaptable to almost any crop-drying situation, and is priced for low investment cost. With multi-purpose bins and racks, it will handle everything from hay to grain and ear corn.



The problem of corrosion of agricultural implements has been solved by a number of farmers in Scotland who are now using flame-cleaning equipment

New Holland's crop drier allows the farmer to bale or chop when his hay is at peak feeding value—before rain can damage the crop. If rain threatens, he can move his crop into the drier for safe automatic drying.

The New Holland crop drier forces heated air through the fresh hay, drying it down to the moisture content that saves valuable protein and carotene and curing the hay for safe storage all winter long.

The New Holland's oil burner allows the farmer to set fuel consumption and air stream temperature for the required heat. On warm, dry days he can even cure crops with forced natural air alone. Big 36-in. fan delivers high air volume—with or without burner. Two-value capacitor 5-h.p. motor drives fan and requires 25% less current than ordinary 5-h.p. motors. If the fan stops or the temperature reaches 165° F., automatic safety devices immediately shut off the burner. If the burner goes out, a flame failure control cuts off the fuel supply for complete protection.

With the drier, New Holland says, a farmer can harvest corn at 28 to 30% moisture. Since stalks are still usually erect at that time, the picker does a better job and more corn gets into the crib. By using the drier good quality hay can be made and fall and spring grain can be stored in good condition.

Thermostatic controls allow easy and accurate temperature control.

The all-steel drier bin has a 24-in. space between walls for maximum drying efficiency and holds 300 bushels. Capacity can be increased by adding additional units.

Because the drying bin is in sections, it operates equally well with full or partially full bins, which makes it adaptable to all farm acreages.

Other features

Exclusive feature of the New Holland drier, and reason for fast, even drying, are its specially engineered augers and large percentage of openings in the bin walls. When a portion of the 24-in. column of grain nearest the air duct loses moisture, that part slides into the elevating auger and more grain is exposed to drying air

Agricultural Chemicals

IN these days of calls for higher agricultural production good husbandry should always take first place in the production of healthy crops, but more is needed. Agricultural chemicals are coming to be used more and more to supplement other practices. Manufacturers have realised that chemicals in the form of fertilisers, insecticides, fungicides, weedkillers etc. are required by the man on the land and this is very apparent from the voluminous literature on new agricultural chemicals that eventually finds its way to the editorial desk. In order to keep our readers informed of recent developments in this field we have decided to incorporate some of this information in a regular monthly feature. Agricultural chemical manufacturers throughout the world may also take advantage of this service by keeping the publishers informed of any new developments for which they may be responsible. Readers who require further information on any of the items mentioned in this section are advised to direct their enquiries to the address given in the panel towards the end of this section.

Since 1954 Fisons Pest Control Ltd. have carried out a large number of experiments using TCA, formulated as 'Tecane', for the control of wild oats in sugar-beet, kale and peas; work on the latter crop was done in conjunction with the Home-Grown Threshed Pea Joint Committee.

Summary of results, using TCA for the control of wild oats in sugar-beet, kale and peas:

In 1954 a limited number of trials were carried out with exceptional results; in fact, over 95% kill of wild oats was obtained. In 1955, 16 experiments were carried out, with an average kill of wild oats of 75%.

In 1956 over 90 farmers co-operated in a farmer panel by carrying out wild-oat control trials and of the counts taken on these farms the average wild-oat kill is again about 75%.

Fisons Pest Control Ltd. feel that a treatment has been found to give the farmer a satisfactory control of wild oats in these crops and, in many cases, to harvest a crop from fields so infested with wild oats that, without treatment, the whole crop would have to be abandoned.

*

It has been announced that a superior formulation of ' Dieldrex A ' has been released to the market by Shell Chemical Co. at a reduction of 20% against last year's prices. This is due largely to increased demand and resultant economies in production.

' Dieldrex A ', which is approved under the British Ministry of Agriculture, Fisheries and Food Crop Protection Approval Scheme, has, as a result of extensive work by Shell Research Ltd., at their Woodstock Agricultural Research Centre, exceptional physical properties, including a welcome freedom from dustiness and is, therefore, all the more agreeable to those dressing the seed.

This dual-purpose seed dressing, containing dieldrin and organo-mercurials, is applied at the rate of 2 oz. per bushel of seed, a dressing rate which not only assists even dressing, but minimises the risk of impairing seed germination, which exists in the use of excessively high concentrations under adverse dressing conditions.

*

The leaflets for ' Ceregam 2 ', ' Tritisan ' and ' Folosan ' are the latest additions to the Bayer information file.

A leaflet on ' Aretan ' has also been published. This product has been manufactured by Bayer Agriculture Ltd. for many years and is well established as an organo-mercurial fungicidal dip for the control of a wide range of diseases in bulbs, corms and seed potatoes. The product is also recommended as a spray for the control of *Fusarium* patch and brown patch in lawns, parks and sports turf generally.

*

Efficient and economical strawberry weed prevention with Crag ' Herbicide-1 ' is described in a new strawberry folder just released by Carbide and Carbon Chemicals Co.

Growers and agricultural experiment stations report Crag ' Herbicide-1 ' can save well over 75% of the labour that would go into hand-weeding, and this new pamphlet shows how strawberry plants grow with increased vigour and give greater yields when strawberry rows are kept weed-free. Crag ' Herbicide-1 ' kills weed seeds as they sprout and will keep out most broad-leaved and grass weeds for three to six weeks. Late summer applications help to prevent early fall and winter weeds.

*

Gemec Chemicals Co., a British division of Carbide and Carbon Chemicals Co., advise us that the parent company manufacture a range of experimental products, which are being extensively field-tested at present. They include dichloralurea (DCU) and glyodin.

*

Malathion is an insecticide of the organophosphorous group which was first introduced experimentally in 1950. It has proved of outstanding interest for controlling a wide range of agricultural pests and for controlling flies, mosquitoes and cockroaches which have developed resistance to DDT and other chlorinated hydrocarbon insecticides. Under the trade name 'Malastan' the Standardised Disinfectants Co. Ltd. have now available the following malathion formulations:

' *Malastan* ' *emulsifiable concentrate* (40% *malathion*).—This product is spontaneously emulsifiable when added to water and forms a very stable emulsion with excellent wetting properties.

' *Malastan* ' *emulsifiable concentrate* (50% *malathion*).—This product must be premixed. Since a spontaneously emulsifiable product is easier to mix, and reduces the chance of incorrect mixing, ' Malastan ' emulsifiable concentrate (40% malathion) is usually the product of choice.

' *Malastan* ' *concentrate* (20% *malathion*).—This product mixes with oils in all proportions to give clear solutions suitable for fogging or larviciding.

' *Malastan* ' *fog solution* (3% *malathion*).—This product is based on a high flash oil especially suitable for thermal fogging.

' *Malastan L* '.—This is a special product combining both malathion and lindane (pure gamma BHC) and is effective, therefore, against a correspondingly wide range of pests.

A new all-purpose residual insecticide has been announced by I.B.F. (Great Britain) Ltd. Originally of Swiss origin, it has met with considerable success on the Continent and is now available in Britain. Available in two forms, one for industrial or indoor use and the other for agricultural or outdoor use, it is claimed that this product destroys all cold-blooded insects. The formulation is based on γ-hexachloro*cyclo*hexane and pentachlorophenate and it is said to be odourless, non-inflammable, harmless to humans and all warm-blooded animals. It is diluted in water before application and may be applied with a spray or brush.

*

Specially designed for the treatment of ships' holds, transit sheds and warehouses is the Waeco Ltd. DDT/lindane preparation. This formulation is supplied as pellets and when ignited in a generator evolves a white insecticidal smoke which activates pests into the open and kills them where they can be swept up. A microscopic deposit of insecticide remains on all surfaces after treatment and prevents reinfestation over a long period.

*

'Gammexane' emulsion concentrate, a product of Plant Protection Ltd., is a clear, pale yellow solution containing 20% gamma BHC, which is equally suitable for dilution with either *water* or *oil* solvents.

Whether water or oil is used as a diluent for the 'Gammexane' emulsion concentrate will depend on the circumstances. Where an oil diluent would create a fire hazard because of the presence of naked flames, the concentrate can be diluted with water to produce an emulsion completely without fire risk. Water is also much more economical than oil. On the other hand, any material that will be marked or damaged by water alone will naturally be affected by the spray.

If water stain is likely to occur, the 'Gammexane' emulsion concentrate can be diluted with a light grade of odourless kerosene or other suitable oil solvent. Oil diluents have advantages for such purposes as the formulation of space sprays for use against houseflies, mosquitoes or moths. The oil itself has an insecticidal action and where quick 'knockdown' is desired, pyrethrin extract—which is not easily incorporated into water-based sprays—can be added. For insecticidal fogging, oil solutions are preferred, as the fog produced is carried a greater distance and is more easily visible.

Pests of grain and other foodstuffs.—Aqueous sprays containing 0.5% gamma BHC are suitable for use in flour mills, breweries, maltings and warehouses where foodstuffs are handled or stored. To control grain weevils, flour beetles, moths etc. and to prevent these and other insects becoming established, apply a residual spray to walls, floors and ceilings, to the internal surfaces of empty grain and malt bins, and to other infested surfaces, after thorough cleaning.

The larvae of Khapra beetles, which are commonly found in maltings, are more resistant to the action of insecticides than most stored products pests and a 1% gamma BHC spray is advised where these insects are encountered. This concentration is obtained by diluting one volume of the concentrate with 19 volumes of kerosene or water.

*

Diazinon is now the active ingredient of Geigy horticultural insecticides sold under the name 'Basudin'. It is a contact insecticide, with a slight penetrative action which is useful against leaf-rolling pests. It does not spot foliage and is not injurious to plants; indeed, it has been found after spraying that apples are improved in colour and thinness of skin. It breaks down rather more rapidly than some of the chlorinated hydrocarbons, which means that residues on leaves and traces in fruit disappear very quickly, and there is little tendency to accumulate in the plant or animal organism.

In the horticultural field, diazinon used in the form of 'Basudin' 20% emulsifiable solution and 20% wettable powder has been found highly effective against many aphides commonly met with on tree and soft fruit, as the bean and cabbage aphides (*Doralis fabae* and *Brevicoryne brassicae*) and *Aphis rosae*. It has also been tried successfully against scale insects and various flies, such as apple and plum sawflies, against codling and other lepidopterous larvae, and against some common spider mites, including the European red (or fruit tree) spider mite (*Paratetranychus pilosus*).

For agricultural use diazinon has been officially approved in many countries, including Austria, Denmark, France, Holland, Sweden and Switzerland. In Turkey it has been widely used with success in the past year or two against *Eurygaster*, an insect pest that has been causing serious damage to wheat in Southern Anatolia.

Promising results from preliminary tests in Kenya, Sudan and Israel, as well as at the Anti-Locust Research Centre in London, now suggest that diazinon may prove highly effective against locusts.

*

The use of chlorophenoxyacetic acids in the form of their derivatives for the manufacture of selective weed-killers has increased greatly during the past years; with widening experience the advantages of the esters over the metallic and the amine salts have become more and more apparent. To meet the growing demand a number of esters of both 2:4-dichlorophenoxyacetic and 2:4:5-trichlorophenoxyacetic acids are now available as part of the 'Bisol' range of organic chemicals, manufactured by the Distillers Co. Ltd., for use in weed and scrub control.

These esters are eminently suitable for preparing self-emulsifying concentrates or oil solutions for spraying. When the final working solutions are adjusted to have the same equivalent acid concentrations, there is no indication that the results obtainable are affected by the particular alcohol used for esterification, except in so far as the differing volatilities of the esters affect the period of action.

'Bisol' 2:4-D and 2:4:5-T esters are claimed to be free from any impurities likely to be deleterious in weed-killing formulations and conform to rigid specifications. The ethyl ester of 2:4-D is a redistilled product of high purity and is a white crystalline solid at ordinary temperatures. All the other 2:4-D esters listed are pale yellow to light brown liquids.

Reader Service

For further information on any item reviewed in this section please write to:

Reader Service
WORLD CROPS,
Stratford House,
Eden Street, London N.W.1,
England

WORLD CROP REPORTS

MEXICO

Good seasonal rains have helped agriculture and the majority of the 1956–57 harvests should be up to estimates. All the dams and reservoirs are now full and there should be no further danger of water shortages this year. So far the rains have done little damage either to roads or to railroads.

Sugar

It is estimated that the 1956 sugar-cane crop will amount to 860,000 tons, a decrease of some 40,000 tons from the record 1955 crop of 901,335 tons. The severe spell of cold weather in January this year damaged the sugar-cane in a number of important sugar-growing zones and the harvests in these areas will be lower than usual.

SOUTH AFRICA

Maize

The Division of Economics and Markets of the Department of Agriculture has raised its estimate of the current season's South African maize crop.

Compared with the season's first estimate of 30,500,000 (200-lb.) bags and 37,387,000 bags last season, the Division now estimates that 34,008,000 bags will be produced this season.

CUBA

Tobacco.—Production and export of tobacco of all kinds is well up on the 1955 figures. It is reported that the value of cigar exports during the first quarter of 1956 was $1.93 million.

Coffee.—The Cuban Coffee Institute has reported that 1,181,000 quintals of coffee were produced in Cuba during the 1955–56 crop year. This is a new record. According to the latest figures, 330,000 quintals have been exported.

EL SALVADOR

White maize (not yellow) is the staple diet of the Salvadorean. The 1954–55 crop produced 185,187 short tons of this commodity, as compared with 173,740 in the previous crop season. In spite of an appreciable increase, it is anticipated that the country will be short, by 40,000 to 50,000 tons, of its annual requirement for 1956, and it is learnt that the Government's Grain Supply Board (Instituto Regulador de Cereales y Abastecimientos) has arranged contracts for the purchase of approximately that amount through brokers in the U.S.A. The country's basic economic problem is that of feeding an already large and expanding population with the produce of a limited land area. The last census of this small country (approximately the size of Wales) taken in 1950, showed 1,855,917 people, but the Government's Statistical Bureau gives the population in 1955 as 2,230,300, an increase of 18%.

Tobacco.—The 1954–55 crop produced 1.5 million lb. (from 2,000 acres), the whole of which was purchased by local cigarette manufacturers.

Henequen.—Production of this fibre for the sack industry is now not sufficient to supply home demands and many hundreds of tons will have to be imported from abroad.

Mangle bark.—The domestic supply of this raw material is fast dwindling and the local leather and tanning merchants are having to import from neighbouring countries while they search for suitable substitutes.

Cane sugar.—Production in 1954–55 was 37,700 short tons, to which should be added a balance from the previous crop amounting to 1,100 tons, making a total quantity available of 38,800 tons. Internal consumption during the year 1954–55 was 35,000 tons, exports 2,000 tons, leaving a balance of 1,800 tons for the 1955–56 season. Estimates for the current crop are 39,400 tons, internal consumption 36,000 tons, which should leave 5,200 tons available for export or for carrying over to the next season.

U.S.A.

The U.S. Commerce Department's weather report for the week ended 15 September states that cool, cloudy weather and light to moderate rains on three to five days in the week delayed completion of the small-grain harvest in North Dakota, Northern Minnesota and the north-east. A week or two of clear warm weather is needed for combining late cereals in the extreme northern North Dakota area.

In contrast, dry, sunny and mostly hot weather with several windy days aggravated droughty situations in the middle and southern Great Plains and increased the soil moisture deficiency eastward over the middle and southern Mississippi valley.

In this region soil preparation and seeding of small grains was generally retarded and most early seeded crops needed rain badly.

Maize

Mostly dry, sunny weather and several very warm days stimulated the maturity and drying of maize. The principal exception was many cool days, much cloudiness and rather frequent rains in the north-east.

In Iowa all maize was denting or dented, with 70% well dented and hard.

About 85% of an excellent maize crop in Illinois is already safe from frost.

Missouri reported that nearly all the maize was mature.

In Indiana 85% was in the dough stage or beyond and 75% safe.

Ohio reported 40% in the dent stage, 50% in dough and 10% in the milk stage or less.

AFGHANISTAN

Cloudbursts and floods in various parts of the country in the second quarter of the year caused much damage to various crops and have also seriously affected the fruit harvest. The earthquakes on 10 June and subsequent days caused considerable damage to agricultural land.

ARGENTINA

The weather to June was favourable to sowing, but tended to retard the movement of maize and the conditioning of cattle.

Wheat

The final estimate of the Ministry of Agriculture for the wheat crop for 1955–56 is 5,250,000 tons. This is 31% less than the 1954–55 crop and 6 and 11% less than the average for the past 10 and five years respectively. The main cause was a decline in the seeded area, which in 1955 was, with the exception of the disastrous drought year, 1951–52, the smallest for the past 50 years. Some 48% of the year's wheat came from the Province of

Buenos Aires, followed by the Provinces of Santa Fe and Cordoba.

The third official estimate for 1955–56 oats, barley and rye production, just released by the Ministry of Agriculture, gives the following figures (with comparative tonnages for previous years):

	1955–56	1954–55	1953–54
	Tons	Tons	Tons
Oats	723,000	890,000	991,200
Barley	951,000	1,112,000	893,600
Rye	653,900	844,100	607,200

INDIA

Sugar

The all-India final estimate of sugar-cane for 1955–56 puts the area under cane at 4.4 million acres, an increase of 11.3% over last year. Production of cane is given as 57.7 million tons, against 56 million tons in the season 1954–55. The increased acreage of cane was shared by almost all the sugar-cane-growing states, especially the U.P., Bihar and the Punjab. The President of the Indian Sugar Mills Association recently said in Calcutta that Indian consumption of refined sugar this season is expected to exceed 19 lakh* tons.

Cotton

The annual report of the Indian Central Cotton Committee, which has just been published for the year ending 31 August, 1955, shows that the area under cotton in India during 1954–55 was 18.3 million acres, against 17.2 million acres in the previous year, exceeding the target of 18 million acres fixed for 1955–56. Production of cotton during 1954–55 was 42.98 lakh bales, against 39.65 lakh bales in the previous season. Over the last three years the mills' total consumption of cotton has increased from 44.8 lakh bales to 47.7 lakh bales. Consumption of foreign cottons has decreased from 8.9 lakh bales to 6.5 lakh bales.

Spec. Reg. Inform. Serv.

ENGLAND AND WALES

Agricultural conditions in England and Wales on 1 September, 1956, have been summarised by the Ministry of Agriculture, Fisheries and Food.

The weather during August was unfavourable for cereal crops. Potatoes made good growth, but widespread blight is reported. Root crops made good progress and average yields are expected. Haymaking has been very protracted and is not yet complete and the feeding value of much of the crop will be below average. Cattle and sheep have done well on the whole.

Weather conditions

The weather during August was generally cool and wet with gale-force winds at times. There were frequent thunderstorms, especially in the southern half of the country. Rainfall was above average in all areas, being particularly heavy in northern districts, where flooded and waterlogged fields are reported. There was a deficit of sunshine and temperatures were below average.

Cereal and pulse crops

The harvesting of cereal crops made a little progress during the month, but the bad weather has delayed ripening of some crops and has retarded progress; in many areas a large proportion remained to be gathered. Localised hailstorms did considerable damage. Forecasts of average yields per acre as at 1 September are given below, but these were made on the assumption of normal weather conditions during the remainder of the season.

Wheat.—Lodging has occurred in some districts and shedding and sprouting are reported, but on the whole wheat has stood well. Ripening has been slow in some districts. On the basis of crop conditions at the end of August the yield of wheat is forecast at 24.9 cwt. per acre, as compared with a five-year average of 23.5 cwt. and a yield of 26.7 cwt. in 1955.

Barley has been badly lodged in many districts. Some crops have been slow and uneven in ripening. The quality and condition of grain are variable, but most samples are poor to moderate. The yield per acre is expected to be 23.3 cwt., as compared with a five-year average of 21.9 cwt. and a yield of 25.4 cwt. in 1955.

Oats have been badly laid in many areas and some loss from shedding is reported. Fair progress was made with the harvesting of winter-sown oats, but spring-sown oats are late in ripening in some districts. The yield per acre is forecast at 19.4 cwt., as compared with a five-year average of 20.3 cwt. and a yield of 22.5 cwt. in 1955.

Mixed corn is expected to yield 20.4 cwt. per acre, as compared with a five-year average of 20.2 cwt. and a yield of 22.1 cwt. in 1955.

Rye has stood fairly well and appears to be a satisfactory crop. The yield is forecast at 20.1 cwt. per acre, as compared with a five-year average of 19 cwt. and a yield of 20.4 cwt. in 1955.

INTERNATIONAL

Sugar

Irish Republic.—The fields are presenting a very healthy aspect and it is anticipated that, given dry weather, an out-turn considerably in excess of last year's figure will be achieved.

Jamaica.—The estimate of the 1956 crop has again been slightly reduced, the Sugar Manufacturers' Association now putting the figure at 356,259 tons, which compares with the 1955 record output of 396,551 tons.

The preliminary estimate of the 1957 crop is revised to 346,800 tons.

Argentina.—Ernesto Tornquist and Co. Ltd., Buenos Aires, in their June report stated that harvesting was in full swing, some of the mills in Tucuman and Santa Fe having started work in the middle of May. Initial yields are similar to those of a year ago, but normal growth of the cane has been adversely affected by lack of sunshine. Furthermore, less cane was planted owing to seed-cane being in short supply following last year's frosts; prospects, therefore, are only fair.

Temporary distribution difficulties were expected to be relieved once the new season's sugar became available.

China (Mainland).—Far Eastern reports state that, according to a spokesman of the Administrative Bureau of Sugar Industry of the Ministry of Food Industry, China's output of sugar this year, under the current five-year plan, will be double that of 1952, the year before the commencement of the five-year plan.

The State has set up experimental farms in Kwantung and Inner Mongolia to cultivate species of sugar-cane and sugar-beet. Experimental farms would be set up in other areas.

More recent advices from the same source state that Mr. Ti Ching-hsiang, Vice-Minister of Food Industry, at a recent planning conference in Peking, announced through Radio Peking that the sugar output would reach 900,000 tons this year, an increase of 24%.

* 1 lakh = 100,000.